PARENT-CHILD INTERACTIONS
IN A FREE CHOICE LEARNING SETTING:
AN EXAMINATION OF ATTENTION-DIRECTING BEHAVIORS

By

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TABLE OF CONTENTS

Page

ACKNOWLEDGEMENTS ii

ABSTRACT vi

CHAPTER

1 INTRODUCTION 1

2 REVIEW OF LITERATURE 6

Museum Research Relevant to Attentional Behaviors 9
Studies of Family Group Interaction in Free Choice Learning Settings 23
Summary 31

3 METHOD 34

Setting 35
Instrumentation 36
Independent Variables 39
Data Collection Procedures 42
  Reliability 42
  Data Collection 43
Data Analysis 45

4 RESULTS 47

Reliability Analysis 47
Repeated Measures ANOVA Analysis 47

5 DISCUSSION 60

Hypothesis 1: Differences in Attentional Behavior as a Function of Exhibit Type . 61
Hypothesis 2: Differences in Attentional Behavior as a Function of Family Type . 67
Hypothesis 3: Differences in Attentional Behavior as a Function of Dyad Type . . 74
Conclusion 75

REFERENCES 81

APPENDIX

1 DESCRIPTION OF PILOT ETHNOGRAPHIC STUDY . . . 90

2 DATA COLLECTION PROTOCOL 93

3 TABLE 7--BEHAVIOR FREQUENCIES PER FAMILY NORMALIZED FOR TIME SPENT IN EXHIBITS 96

4 TABLE 8--BEHAVIOR FREQUENCIES FOR DYAD TYPES 106

5 SUMMARY TABLES FOR NON-SIGNIFICANT REPEATED MEASURES ANOVAs 110

BIOGRAPHICAL SKETCH 116

Abstract of Dissertation Presented to the Graduate School
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PARENT-CHILD INTERACTIONS IN A FREE CHOICE LEARNING SETTING: AN EXAMINATION OF ATTENTION-DIRECTING BEHAVIORS

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This researcher analyzed parent-child attention-directing interactions observed in a museum. The questions addressed were as follows: Do certain exhibit types elicit more attentional behaviors than others? Do frequencies of attentional behaviors vary as a function of age of children (family type)? Do frequencies of attentional behaviors vary as a function of sex of parent-child dyads (dyad type)?

Data for 56 families on 13 types of attentional behaviors were collected and analyzed, utilizing a 4(exhibit type) X 3(family type) X 4(dyad type) analysis of variance (ANOVA) with repeated measures on the first factor, to determine the effect of exhibit type, family type, and dyad type on frequencies of these behaviors.

It was hypothesized that exhibit type would influence the frequency of attentional behaviors, with more behaviors observed in participatory exhibits. It was also hypothesized that the frequency of attentional behaviors would vary as a function of family type, with families with older children exhibiting more behaviors than families with younger children or families with a combination of ages. The frequency of attentional behaviors was also expected to vary as a function of dyad type, with fathers and mothers more likely engaging in exhibit-related and setting-related behaviors with sons than with daughters.

Generalizability analysis established instrument reliability for a subset of 15 families and significant results were observed for 4 of the 13 attentional behaviors ($p < .05$). Significant three-way interactions were obtained for the two questioning variables analyzed, indicating that the effect of exhibit type, family type, and dyad type on questioning is complex. A significant three-way interaction was obtained for one of the two explanation variables. A significant main effect for exhibit type was obtained for the non-interaction variable.

Results indicated that questioning is a dominant behavior in the family museum experience and is influenced by exhibit type, dyad type, and family type in a complex fashion reinforcing the interactive nature of variables in these settings. The findings contribute to theory regarding family behavior in free choice learning settings and provide insights to museum professionals designing exhibits and programs for the family audience.

CHAPTER 1
INTRODUCTION

Almost every metropolitan area has some type of free choice learning setting, such as a museum, a zoo, or a botanical garden (Laetsch, Diamond, Gottfried, & Rosenfeld, 1980). The United States has some 6,000 museums which annually attract more than 300 million visitors. Major league sports garner only 70 million admissions annually (Koran & Dierking-Shafer, 1982).

Family groups constitute a major portion of the visitors to these settings (Laetsch et al., 1980). Alt (1980) observed that 70% of the visitors to the British Museum of Natural History who were not in school groups came in other social groups and that 60% of these groups were family groups. A similar pattern of visitation has been observed at other institutions (Balling, Hilke, Liversidge, Cornell, & Perry, 1985; Borun, 1977; Cheek, Field, & Burdge, 1976; Ham, 1979). Despite the fact that families constitute a major portion of museum visitors, there is a paucity of systematic research about family museum behavior that attempts to apply current theory in any related discipline or to generate inferential data to guide museum design or practice. This need for systematic museum audience research was recently addressed by Alexander and Weinland (1985).

This is not to suggest that research is not being conducted in museums. Researchers from a variety of disciplines, including education, psychology, sociology, and anthropology, are exploring learning in free choice settings. Most of this research, however, has involved school groups, guided tour populations, or other contained groups. Reviews of this body of research can be found in Falk, Koran, and Dierking (1986); Koran and Dierking-Shafer (1982); Koran, Longino, and Dierking-Shafer (1983); and Lucas (1983). These reviews suggest that progress is being made and that generalizations for these groups are emerging that address the following questions: a) Who is the visitor, what is his motivation for being there, and what does he do once there? b) How should exhibits be designed utilizing attentional adjuncts and sequencing to maximize visitor attention, processing, and recall of exhibited material? c) How does visitor knowledge and experience affect the museum visit (Koran & Koran, 1986; Shettel, 1973, 1978)?

In the area of family museum behavior only one basic question has been addressed as follows: Why are families there and what are they doing while there (Borun, 1977; Cone & Kendall, 1978; Diamond, 1980; Hilke, 1984; Lakota, 1975; Rosenfeld, 1979, 1980)? Results of such studies tend to be fairly specific to the museum in which they were conducted. Virtually nothing has been done to study the effect of varying exhibit characteristics on attention levels within families or to design exhibits that maximize family interaction. This study dealt with the inadequacy and lack of research in the area by analyzing parent-child interactions and interpreting the results utilizing current psychological theory. Findings from studies of this type could contribute to a knowledge base influencing exhibit designs that maximize family attention.

The other problem alluded to earlier, lack of systematic study, is actually a concern raised in all areas of free choice learning setting research, not just in the area of family behavior. As suggested by Koran and Koran (1986) what is missing is an organizing framework for guiding inquiry. Earlier research has been conducted on a purely empirical basis and there has been little attempt to relate it to any theoretical framework in relevant disciplines. If such efforts had been made it would have been possible to compile a systematic body of findings which could be used by researchers to organize and guide future investigation. It would also facilitate the integration of research results with the larger bodies of research in education, psychology, sociology, and anthropology, from which the research was originally generated, and upon which it will undoubtedly continue to draw.

In this study the researcher attempted to analyze some specific aspects of family museum behavior and to utilize relevant psychological theory to interpret this behavior. In particular, the researcher was interested in observing behaviors from which inferences could be drawn about attention. For the purposes of this study the following operational definitions pertain:

1) attention-directing or attentional behaviors are orientation behaviors that involve directing or focusing learner behavior on relevant attributes of a stimulus that may result in learning (Bransford, 1979; Rothkopf, 1966, 1970, 1973).
2) exhibit taxonomy is a classification system for exhibits enabling systematic study. This taxonomy places exhibits on a continuum ranging from "static" exhibits (standard case exhibits), to walk-through or life size diorama-like exhibits to participatory exhibits where visitors can touch and manipulate objects or events (Koran, Lehman, Dierking-Shafer, & Koran 1983; Lee, 1969) and was utilized here for purposes of discussion, as well as in the design of this study.

The major questions addressed in this study were

1) Do certain types of exhibits elicit more attentional behaviors than other types?
2) Do the frequencies of attentional behaviors vary as a function of the age of children (family type)?
3) Do the frequencies of attentional behaviors vary

as a function of the sex of parent-child pairs (dyad type)?

In summary, the problem that this researcher explored is how do families behave in museums with regard to attention and how can the observed behavior be interpreted by current research in cognitive psychology.

CHAPTER 2
REVIEW OF LITERATURE

A model based on cognitive theory suggested by Koran and Koran (1986) and adapted from Bransford (1979), Jenkins (1979), and Brown, Campione, and Day (1981) was used as a guide for exploring the variables examined in this study (see Figure 1) and served as a framework for interpreting the research findings. This framework involves the consideration of four categories of variables and their interactions when exploring learning in the free choice setting: a) characteristics of visitors such as age, sex, knowledge, and attitudes; b) visitor processing activities such as attention, coding, memory storage, retrieval, and other processing and orienting activities; c) characteristics of exhibits such as static, dynamic, and walk through; and d) desired outcomes such as knowledge, curiosity, and motivation. Within each of these categories there are a multitude of other variables that could be studied. In Figure 1 the "O" represents the visitor and the variable categories that impact upon his visit radiate from the center. Any question about museum learning involves simultaneous consideration of all four of these categories of variables and as each problem is explored, these variables come into play as a basis for interpretation.

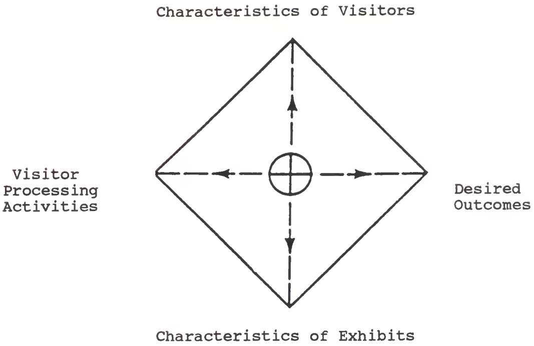
Characteristics of Visitors
Visitor Processing Activities
Desired Outcomes
Characteristics of Exhibits

Figure 1. Cognitive model for examining free choice learning setting research (reproduced with permission from Koran and Koran, 1986, Fig. 1).

Take, for example, the question of why an exhibit, designed to hold a family's attention and to provoke curiosity, is not producing these desired outcomes. This could occur because members of the family lack relevant prerequisite knowledge or abilities; thus failure is a function of the relationship between the characteristics of the visitor and the characteristics of the exhibit. Failure could also occur due to the visitor not knowing how to approach a particular learning task in an efficient manner, in which case the failure would be a function of the relationship between visitor processing activities and the characteristics of the exhibit. Or one might determine that the characteristics of an exhibit are effective for producing one type of outcome, but not another. For example, an exhibit, designed to simulate a particular environment, may provide the visitor with contextual information regarding that environment, but do little to actually convey concepts about the environment. The outcomes predicted for that exhibit would be more affective than cognitive. In this case, if cognitive outcomes were the outcomes of choice, failure would be due to the relationship between the characteristics of the exhibit and the desired outcome. Thus, although the framework is a simple figure, it represents a complex set of relationships.

Utilizing this model as a guide, the researcher attempted to determine factors that influence attentional behavior within families. Two of the independent variables (categorical independent variables), family type and dyad type, pertain to the characteristics of visitors' category and the other independent variable, exhibit type, is related to the characteristics of exhibits' category in the aforementioned model. The dependent variable, attentional behavior, is certainly a desired outcome, but also relates to the processing activities of visitors. Attentional behavior is considered in an attempt to understand family interaction patterns in a free choice learning setting and to discover ways to influence attentional behaviors and the resulting inferred cognitive processing activities of museum visitors.

Museum Research Relevant to Attentional Behavior

Museum learning researchers have long recognized that attention is a critical factor in understanding museum visitor behavior (Dierking, Koran, Lehman, Koran, & Munyer, 1984; Falk, 1986; Falk, Koran, Dierking, & Dreblow, 1985; Koran & Koran, 1984; Shettel, 1973). Shettel, Butcher, Cotton, Northrup, and Slough (1968) were among the first to focus on this variable and proposed a three-factor theory of exhibit effectiveness suggesting that an educationally effective exhibit must first attract viewers, maintain their attraction, and provide useful information.

Much of the research conducted in museums in recent years has specifically dealt with techniques for directing and controlling attention (de Waard, Maistre, & McNamara, 1974; Dierking et al., 1984; Koran, Lehman, Dierking-Shafer, & Koran, 1983; Screven, 1974a, 1974b, 1975; Shettel, 1973, 1978; Shettel et al., 1968). In these studies, such techniques as providing visitors with behavioral objectives; using teaching machines, programmed cards, audio cassettes, punchboards, and question sheets; or having researchers incorporate attentional adjuncts into the exhibit design predominated. The studies were primarily conducted utilizing standard case exhibits and most of these procedures, to a greater or lesser degree, aided viewers in directing their attention, resulting in significantly increased learning. In two of the studies, Dierking et al., 1984, and Koran et al., 1983, the results were equivocal.

In the 1984 study the equivocal results were due to the nature of the learning task, a concept learning task requiring attention to non-relevant attributes as well as relevant ones, and the exhibit design which utilized recesses to focus attention on the relevant exemplars (interaction between characteristics of exhibits and visitor processing activities). It appears that the recesses were so convergent in their attention directing function that their true influence was hard to differentiate in the inductive and deductive treatments. The 1983 study's results were due in part to the uncharacteristically high IQ's of the subjects (characteristics of visitors) which enabled them to utilize a learning strategy, backward-review (in this case, both an exhibit characteristic and a visitor processing activity), which is not usually beneficial to "less able" subjects. Consequently, the high IQ sample did equally well in both treatments but also the treatments exceeded a control's performance. For the most part, however, the results of these attention studies have indicated significantly increased learning when attention-directing and attention-controlling techniques are incorporated into the exhibit design.

In an article reviewing research on the role of attention in children's learning of science concepts (Koran & Lehman, 1981), it was emphasized that children's attention had to focus on the relevant characteristics of the objects or events used in the teaching in order for learning to occur. Koran and Lehman (1981) reported that verbal directions, arrows, teacher pointing, and questions all functioned to direct children's attention. Depending on the child's age, color was found to aid in directing attention for younger children, while shapes tended to be more compelling for older children.

Both color and shape apparently stimulate attention and curiosity, and museum designers freely use combinations of these to produce an artistic or dramatic effect, often without thought regarding their effects on learning of different age groups. Since families are often composed of children varying in age, these findings have strong implications and illustrate the interaction that exists between categories of the previously described model. In this particular example, visitor processing activities (attention behaviors, encoding) are affected by characteristics of the visitor (family type) such that one would anticipate that the desired outcomes would differ significantly depending upon the age of the children in the family. It would also seem that exhibit type would be an important variable to consider here. Are these generalizations regarding attentional behavior consistent for all exhibit types or can the characteristics of particular exhibits influence the results as one would predict from the theoretical model? In this study the researcher analyzed the influence of age of children in a family and exhibit type upon attentional behavior in order to deal with such questions.

Studies utilizing experimental, quasi-experimental, and naturalistic methods and focusing on museum and field trip learning for school groups also appear in the literature (Falk, Martin, & Balling, 1978; Gennaro, 1981; Koran et al., 1983; Koran, Koran, Dierking, & Foster, in press; Koran, Morrison, Lehman, Koran, & Gandara, 1984; Linn, 1980; Martin, Falk, & Balling, 1981; Sneider, Eason, & Friedman, 1979; Wright, 1980). The aforementioned studies by Falk, Martin, and Balling (1978) and Sneider, Eason, and Friedman (1979) were designed to explore the effects of the "novel field trip" on middle school age students' conceptual learning. Since natural history museums and science centers can be considered "novel environments" and the exhibit continuum ranges from novel to familiar, the results of these studies are relevant. They found that when the outdoor environment is novel, less conceptual material is learned than when the setting is familiar. It appears that novel environments stimulate students to direct their attention away from structured learning activities toward other components of the environment. Once the environment becomes "familiar," students are better able to focus on the conceptual tasks. This line of inquiry has implications for how we may control attention in informal settings and what we can expect as outcomes of informal experiences. Individuals who are not frequent visitors may perceive much of what they see in a museum as novel, particularly if the museum has many participatory exhibits, a recent trend in museum exhibit design. Until those visitors are able to find the surroundings familiar, our expectations for their attention levels and subsequent learning may need to be readjusted. Certainly, this would be the case for family visits, where 40% were found to be first time visitors (Falk, in press). The findings indicate that with these individuals, if conceptual learning is the desired outcome of a museum visit, a reduction in novelty by utilizing preinstruction or orientation and familiar attention-directing devices in exhibits or other methods of orientation could help.

Gennaro (1981) conducted a study in which he evaluated the effectiveness of previsit instructional materials on learning from a museum visit. Prior to their visit, experimental subjects (eighth graders) received advanced instruction on what they would be seeing; control subjects did not receive this orientation. He found that the previsit instructional materials were useful for students of all abilities in the treatment group and that the treatment group exceeded the control on a content measure. This finding is consistent with another study (de Waard, Maistre, & McNamara, 1974) and also with general knowledge regarding how to influence attention to facilitate learning (Bransford, 1979; Gagne, 1970, 1973). Results from such studies confirm that there is a strong relationship between attention and learning in informal settings and are consistent with research in school learning (a formal setting). When attention-directing devices were utilized, learning was enhanced. Researchers in this area have proposed that such devices required subjects to direct their attention to the more distinctive properties of the objects or prose materials, thus facilitating learning. However, in addition to the latter effects, a number of these studies confirm the need to reduce novelty so that attention would become more focused rather than diffuse.

Another factor described as critical in the Koran and Lehman (1981) review was the amount of time a learner spent observing and manipulating objects and events that contribute to defining concepts. Nahemov (1971) and Danilov (1979) both emphasized that in multidimensional environments, such as museums, with the tremendous number of stimuli, visitors have difficulty focusing their attention and remaining attentive long enough for information processing to occur. Both argued for attention-directing devices or cues which would help visitors orient themselves to the relevant attributes of an exhibit. Screven's work (1974a, 1974b, 1975) and other research (de Waard, Maistre, & McNamara, 1974; Dierking et al., 1984; Koran et al., 1983; Shettel, 1973, 1978) support this observation. The current trend in museums toward increasing complexity of exhibits (from static to dynamic) suggests that adjunct attention-directing devices may be essential for learning and remembering. Since it has been observed that the average visitor spends less than thirty seconds viewing an exhibit (Shettel et al., 1968) and if one considers that the potential number of perceptive modes increase significantly as one shifts from static (case exhibits) to dynamic exhibits (participatory exhibits), a thirty-second attention time appears inadequate for many kinds of instructional outcomes. How does a family, a group by definition including a broad range of ages, sex, and entering knowledge and attentional capabilities, deal with increasing exhibit complexity? One of the major issues addressed by this research is how exhibit characteristics influence attention in families. Do the more participatory exhibits hold attention longer and elicit different attentional behaviors when families view them, than when families interact with a static display? Or do they prove to be so novel or complex so as to result in family members directing their attention to other factors in their environment?

As described earlier, the taxonomy utilized in this study places exhibits on a continuum ranging from "static" exhibits, the above mentioned standard case exhibit, to walk-through or life size diorama-like exhibits to participatory exhibits where visitors can touch and manipulate objects or events. In this study it was thought that the more participatory an exhibit became, the more one would expect families to engage in attending behaviors. Furthermore, it was hypothesized that the more participatory an exhibit, the more one would expect families to engage in attending behaviors associated with processing activities such as questioning, explaining, or engaging in a conversation related to the exhibit. Research and observations at the Florida State Museum, University of Florida, focusing on attention, provide some additional insights. In a study conducted with a college class it was determined that walk-through exhibits, such as the Mesic Hammock exhibit in this study, require attention-directing preinformation, as well as postinformation retrieval cues, so that visitors attended to relevant objects and events initially, enabling them to review and recall what they had seen after exiting the exhibit (Koran et al., 1983). The latter study was conducted with school groups or college classes so replication with casual visitors, such as families, would appear warranted.

In two other studies (Koran et al., in press; Koran, Longino, & Dierking-Shafer, 1983) involving casual visitors, age and sex differences were observed in museum settings when visitors were confronted with static and dynamic exhibits. These age and sex differences had attentional implications. When analyzing for age, results indicated that adults, of both sexes, were less likely than children to touch objects, if they were available, or to linger at an exhibit. When adults could touch an object and did, however, they spent more time with it than if they could only view the same object. At an individual exhibit, adult males perused objects quickly and covered more stimulus situations, while females focused on one object and lingered longer with it.

In two separate but related studies, one conducted at the Florida State Museum (Falk et al., 1985) and the other at the National Museum of Natural History (Falk, 1986), researchers examined what visitors attended to during the course of their visit. Despite the fact that these museums were very different, similar patterns of visitor attention behavior were observed. The visit could be divided into four distinct phases: a) orientation phase, lasting 3-10 minutes, when visitors begin their tour and become familiar with surroundings; b) intense exhibit viewing, lasting 25-30 minutes, when visitors concentrate attention on exhibits, reading labels and interacting in an exhibit-directed fashion; c) exhibit skimming, lasting 30-40 minutes, when visitors scan exhibits quickly, infrequently reading labels; and d) preparation for departure, lasting 5-10 minutes, when visitors prepare to exit the museum. The results of these studies seem to suggest that museum attention behavior is orderly and predictable, despite unique characteristics of individual museums and exhibits, a perspective different than most of the attention studies.

Other research in cognitive psychology provides insights into the variables influencing the information processing abilities of individuals. This research can also be interpreted in terms of the Koran and Koran (1986) model and can be used to address the questions regarding family attentional behavior in this particular study. As suggested by Koran and Koran (1986), individual differences among visitors to a museum constitute an important class of variables that can, and should, be explored in the museum setting. These differences are defined as any characteristic of the individual's cognitive, affective, psychomotor, or developmental state which functions selectively with respect to a visitor's reaction to an exhibit. Some could facilitate learning, interest, or motivation, while others could interfere with the effectiveness of a given exhibit (Koran & Koran, 1984). Clearly, such differences may be expected to interact with the type of exhibit one confronts, the way one will attend to an exhibit, and the potential outcomes derived from this experience (see dotted lines in Figure 1).

When confronted with an exhibit (stimulus) visitor processing involves paying attention to the exhibit, perceiving the exhibit using all available and appropriate senses, and coding or internally converting the stimulus for long-term memory and retrieval. Adjuncts such as providing information panels prior to, and following, a large exhibit such as a walk-through limestone cave, might provide the same internal processing effect as a premuseum visit discussion or lecture for school students. Other adjuncts that might produce similar internal processing effects include problem sheets provided to visitors prior to an exhibit, headphone tapes that cue visitors to relevant attributes of an exhibit, and docents available near exhibits to highlight features of the exhibit for casual visitors.

Visitors may engage in a wide variety of activities or processes when viewing an exhibit. For example, the visitor may try to remember details, predict outcomes, incorporate the informational content into prior knowledge possessed, or seek relationships or analogies to prior knowledge, depending on the orienting or processing instructions provided by the museum exhibit and/or the particular desired outcome (Koran & Koran, 1986).

Characteristics, such as age and sex, are clearly related to the manner in which visitors react to hands-on exhibits or case exhibits (Koran, Koran, & Longino, 1986). Results of this study indicated that a) children and young adolescents spent longer periods of time viewing a hands-on exhibit than did adults and b) attraction to participatory exhibits was sex-related, with females of all ages exceeding males in attraction to these exhibits. Diamond (1980) and Rosenfeld (1980) also found behavior affected as a function of sex in their studies of family museum behavior; however, their findings indicated that males were more likely to take an active role in the visit than females. Family groups were not included in the Koran, Koran, and Longino (1986) study, but the conflicting results raise some interesting questions. Was it the content of this particular exhibit (shells) that women found so much more compelling or do women and men assume certain roles when they are part of a family group regardless of the stimulus? McManus (1987) discovered that women in all adult groups were much more likely to be exploratory than males, but when in family groups with men present, they did take a less active role in the group, primarily engaging in management behaviors, as observed by Diamond (1980) and Rosenfeld (1980). McManus suggested that the social situation seemed to dictate the role that the woman assumed during the visit.

The role of prior knowledge is also an important variable to consider when analyzing family behavior in museum settings. Shettel et al. (1968) observed that people who enter an exhibit situation with more science knowledge tend to learn more than those with less prerequisite knowledge. This finding is supported by psychologists who contend that one of the most important variables for a learner in a learning situation is his prior knowledge of the area (Ausubel, 1963, 1968; Bransford, 1979; Gagne, 1970; 1973; Wittrock, 1979). Certainly, prior knowledge is affected by the age of children in a family. For example, it could be assumed that a child of four probably has less prior knowledge and experience regarding content one would find in a museum, and less experience with museums in general, than a child of ten. They also require information presented in a concrete fashion (Inhelder & Piaget, 1958;

Lawson & Wollman, 1976). For a young child, the more concrete an exhibit, the more easily the information may be processed (Falk, in press; Falk, Koran, & Dierking, 1986). Yet, it is a factor that is frequently not taken into consideration by museum exhibit designers.

The characteristics of the individual exhibits attended to by the visitor also play a vital role when attempting to understand differences in the cognitive abilities of individuals. Any highlighting or cueing which can be provided in the physical design of the exhibit should enable parents to attend to relevant attributes of the exhibit, and in turn, cue their children regarding them or visa versa.

In summary, the researcher analyzed parent-child interactions and focused on one behavior category: attentional behaviors. Attentional behaviors can certainly be considered an outcome variable, but can also be viewed as an important processing activity. Do certain types of exhibit characteristics elicit this response more frequently? Do attentional behaviors vary as a function of the age and/or sex of children in the family? The researcher attempted to explore these issues in this study.

The research reviewed suggests that there are several factors impacting upon individuals' information processing abilities in museums including not only their age and sex, but also their entering knowledge and prior experience, the characteristics of the individual exhibits with which they interact, and the particular information processing strategies they utilize. The results of this research suggest that it is crucial to develop generalizations regarding the information processing capabilities of individuals, in the context of their family group. One anticipated result of this study is to provide generalizations regarding attentional behavior within families as a function of exhibit type, family type, and dyad type.

The results of research reviewed here, primarily conducted with visitors in prescribed groups, also suggest the feasibility of studying attention and learning using both experimental and naturalistic methods and the critical role of attention-directing and focusing devices and preinstruction in visitor learning in museum settings. It also highlights the function that attention plays in information processing. The theoretical model utilized and the research it incorporates are relevant to studying casual family visitors for the following reasons: a) Attention is an important prerequisite to any further information processing required for learning, so in order to analyze how families learn together it is important to first understand the nature of their attentional behavior and what factors influence it. b) It appears that attention is affected by age and sex. c) It appears that attention is profoundly influenced by novelty and, since many families are on their first visit, novelty is surely a factor affecting the visit, as well as a differentiating factor in the three categories of exhibits previously discussed.

Studies of Family Group Interaction in Free Choice Learning Settings

Despite the fact that families constitute the largest portion of informal learning setting visitors, there are few studies of families in such settings. The studies that do exist are primarily descriptive in nature, dealing with how families interact with specific exhibits in a particular free choice learning setting. However, the following represent a selected group of these studies which provide insights into some of the aspects of the attentional behavior of families.

In a study conducted by Lakota (1975) at the National Museum of Natural History, adult-child groups were compared with all adult groups and their behavior described. Lakota (1975) observed a very stable pattern of interaction within families. Adults selected the hall or exhibit to be viewed based on their familiarity with the subject matter. He explained this by stating that perhaps adults wanted their children to view what they liked or what they could answer questions about. Once the hall or exhibit was selected, the child determined the level of interaction.

Although both attracting power and holding power were important variables in the model generated for all adult groups (adults did not necessarily interact with all exhibits they viewed), attracting power was the only important predictor variable for adult-child groups. Once attracted to a particular exhibit, families remained, continued to interact with the exhibit, and then moved on; there was very little variance in the time they spent from exhibit to exhibit. This study did not specifically address attention. However, it does suggest that the exhibit characteristics were important factors influencing attention.

Cone and Kendall (1978) studied family interactions in a Minnesota science museum and observed that the average amount of time a family spent in a particular hall was 10 minutes; the average time they spent in front of a display was 30 seconds. Almost no family attended to all exhibits in a hall. Dioramas were the most remembered types of exhibit while little attention was paid to charts and graphic displays. One might hypothesize that the diorama, like a walk-through exhibit which simulates a particular environment, attracted the attention and curiosity of family members, facilitating the encoding of the information contained within it. It was suggested in the previous section of this literature review, that the more concrete an exhibit the more easily the information may be processed and it is possible, too, that even though there are many stimuli to attend to, the fact that the diorama is visual and "picture-like" may increase the probability of it being remembered. There is evidence in the visual instruction research suggesting that materials that can be imagined, for example, pictures, are remembered more easily than words (Jenkins, Neale & Deno, 1967; Paivo & Csapo, 1969). It is unfortunate that Lakota did not provide details on the characteristics of the exhibits that attracted families the most and a greater insight into visitor attentional behavior.

Diamond (1980) conducted an ethnological study of adult-child groups in the Lawrence Hall of Science at Berkeley and the Exploratorium in San Francisco. She was interested in studying how social interactions affect the ways people interact within an environment. One important finding was that most families do not read participatory exhibit instructions before they interact with them. They try to understand by manipulating first and then read the instructions if they are unsuccessful. It is very possible that the exhibit itself aroused such curiosity that the visitors' attention was initially drawn to the objects, rather than to the instructions. It was only after successful manipulation had not been attained that they redirected their attention to the instructions. This explanation is supported by psychological research indicating that attention is a limited process. The more attention spent focusing on one cue, the less available for other cues (Bransford, 1979; Egeth, 1973; Kahneman, 1973; Zeaman & House, 1963). Because attention appears to be limited, the importance of attention-focusing devices in situations where there are participatory exhibits seems essential. However, this is just a supposition since Diamond did not use an observational method which permitted differential attention to be examined as closely as in this study.

Diamond (1980) also observed distinctive patterns of interaction and exploration in the science museum between parents and children. Children were significantly more likely than parents to manipulate exhibits, while parents were much more likely to look at graphics and read labels. These results are supported in studies described by Koran and Koran (1984); Koran, Koran, and Longino (1986); and Koran et al. (in press), in which it was found that children were much more likely to touch and interact with a hands-on exhibit than adults. These researchers suggest that novelty and curiosity are much more likely to be a factor in the behavior of children because adults are often familiar with many of the stimuli children find novel. Another explanation is that children have not been as socialized "not to touch" in museums as have adults. One of Diamond's most interesting findings was that there were a number of differences in the behavior of family members related to the sex of the subject. The behavior of mothers was distinguished from the behavior of other members of the group. They were less likely than others to choose what exhibits to view and more likely to follow other members of the group to the exhibits.

Father-son interactions also differed from mother-daughter interactions when viewing exhibits. When a son approached his father at an exhibit, the father might read aloud, show or describe the exhibit, or ask a question about the content. These interactions did not occur between mothers and daughters. Unfortunately, there were no data describing father-daughter or mother-son interactions. The present study did include the attentional behaviors of mother-son dyad pairs and father-daughter dyad pairs.

Rosenfeld (1980) conducted a study in which he analyzed family group behavior in the San Francisco Zoo and in a minizoo at the Lawrence Hall of Science at Berkeley. Successful exhibits, as measured either by attending time or the social interaction they elicited, in both zoos seemed to depend upon there being some interaction among animals or between animals and people. Once again, this would suggest the importance of the characteristics of the exhibits when determining the success of an exhibit. It would seem that those zoo displays where animals and/or people were interacting elicited a curiosity response; thus, these displays attracted visitors and increased their attending time. This lends credibility to the assumption made in this study that the more exhibit characteristics move toward being participatory, the more likely the exhibit is to increase curiosity behavior and consequently attending time. It was also determined that giving visitors an opportunity to interact with animals and to manipulate variables in exhibits (i.e., experiment, make guesses, etc.) improved the level of verbal interactions, although generally the questions observed being asked were concrete in nature.

Rosenfeld also observed, as Lakota (1975) had, that adults controlled the pace of family visits. His findings also supported Diamond's (1980) finding that when adult males were present in a group they were the dominant leaders. Sex differences were considered in this study and the results compared to Diamond's and Rosenfeld's findings in the discussion.

As mentioned in the previous section, McManus (1987) also analyzed visitor behavior in the British Museum. Her study was not specifically a study of families, but she did investigate the behavior of adults in all adult groups and compare it to their behavior when with children. Women, when in all adult groups, were much more likely to be exploratory than men. This is consistent with the finding of Koran, Koran, and Longino (1986) and Koran et al., in press. Men, when in groups with children, were much more likely to assume the didactic teacher role, than women.

A study with family groups by Borun (1977) was designed to investigate the effect of three different forms of orientation pamphlets, available at the entrance desk of the Franklin Institute in Philadelphia. Her technique was to measure performance on a multiple choice test using a picture stimulus and an answering machine and compare the performance of different previsit and postvisit groups.

Users of the "museum highlights" brochure did not make a significant improvement on tests of knowledge, nor did their attitudes towards science change. However, parents who used a "search and discover" brochure with their young children and users of a museum adventure trail showed gains in knowledge and showed more favorable attitudes. It is possible that their titles ("search and discover" brochure, museum adventure trail) created more of a curiosity response and also prompted more information processing activities. This curiosity response may have functioned to direct the attention of the children and adults, facilitating the encoding of relevant information into short-term memory.

Balling et al. (1985) conducted a study at the National Museum of Natural History in which they contrasted family interactions when they were in traditional exhibit halls with interactions when they were in the Discovery Room, a participatory gallery. They observed some profound differences in their behavior: a) Sixty-three percent of all nonverbal behaviors in the traditional exhibit hall were looking behaviors, while only 35% of the nonverbal behaviors observed in the Object Gallery were looking behaviors. Forty percent of all the nonverbal behavior in the Discovery Room involved some sort of direct manipulation of the exhibit. b) Less "explanatory" verbal behaviors were recorded in the Discovery Room than in the traditional exhibit hall. c) More questions were asked in the Discovery Room. d) More time was spent at each exhibit in the Discovery Room. With the exception of the "explanatory" verbal behavior, these findings certainly suggest extending this research to the hypotheses tested in this study.

The studies of family groups that have been conducted in free choice learning settings suggest that a) attracting power seems to be the primary factor in determining which exhibits families will view and how long they will stay; b) dioramas or zoo exhibits, in which there is some interaction between animals or between animals and people, are the most remembered types of displays viewed; c) families do not read participatory exhibit directions before attempting to interact with them and only do so if attempts at interaction are unsuccessful; d) children are much more likely to touch and interact with a hands-on exhibit than adults; and e) mothers are much less likely than others to choose what exhibits to view and more likely to follow other members of the group to the exhibits. These generalizations are interesting; however, they fail to address a number of important questions. Among these are the following: What are the attentional factors responsible for a family remembering dioramas more than other types of exhibits? How do the information exchanges between mother-son dyad pairs compare with those between father-daughter dyad pairs? Can attention and curiosity provide explanations for some of the above generalizations? The researcher attempted to extend the line of inquiry regarding family behavior in museums by considering the role that attentional behavior plays during the museum visit. It was hoped that this information would provide a valuable resource for assisting museums to help families to maximize the learning potential of free choice settings.

Summary

The studies cited here suggest that there was a need to extend existing research to include consideration of the role of attention during family visits to museums. Generalizations regarding attention are beginning to emerge for the visitor in a prescribed group, but it still is not clear if these findings are consistent for the casual family visitor. Since families constitute a major group of visitors in a free choice learning setting, and since descriptive research suggests the importance of attentional behavior during their visits, it is essential to systematically study this phenomenon. If, for example, certain types of exhibits are determined to elicit more attentional behavior, museum design may be altered to use them more frequently. Museum administrators may want to place exhibits in certain locations within the free choice setting, invest more money in designing certain types of exhibits, or add attentional adjuncts to pre-existing displays. Findings may suggest a need for policy regarding the sequence and types of exhibits provided for visitors of varying ability and for constructing protocols for docents, parents, and their children. Such research and development could have a profound influence on the knowledge regarding family behavior and consequently, upon museum management systems and operations.

It will be recalled that the major questions to be explored in this dissertation study were as follows:

1) Do certain types of exhibits elicit more attentional behaviors than others?
2) Do the frequencies of attentional behaviors vary as a function of family type?
3) Do the frequencies of attentional behaviors vary as a function of dyad type?

The preceding review of research suggested the following hypotheses:

Exhibit Type

Hr_1 It was hypothesized that exhibit characteristics would influence the occurrence of attentional behaviors. The more an exhibit provided opportunities for touching, manipulating, and "experiencing" the objects and concepts presented, the more different types of attentional behaviors would be observed.

Family Type

Hr_2 It was hypothesized that attentional behaviors would vary as a function of the age of children in the family, and therefore, families with older children were expected to exhibit more attentional behaviors than families with younger children or families with a combination of ages.

Dyad Type

Hr_3 Attentional behaviors were expected to vary as a function of the sex of parent-child pairs such that it was hypothesized that fathers and mothers would be more likely to engage in attentional behaviors related to the exhibits and the setting of the free choice learning environment with sons than with daughters.

Information derived from testing these hypotheses could suggest the importance of attentional behaviors when analyzing family interaction, could subsequently contribute to cognitive theory regarding family interaction in museums, and could provide the basis for museum professionals to design, and redesign when necessary, exhibits and programs for the family audience and to sequence a variety of exhibits differently than they might ordinarily.

CHAPTER 3
METHOD

This study was an extension of a study that was conducted at the Florida State Museum on the University of Florida campus (Falk et al., 1985). The aforementioned study was designed to examine what visitors attended to during the course of their visit. Different individual visitors (alone or part of a group, but not necessarily a family group) were followed in a fashion similar to the procedure utilized in this study. Every five seconds it was noted whether the individual was attending to an exhibit, the setting, their own social group, or another social group. Five individuals were trained to follow visitors and code their behavior. Videotapes of visitors were utilized to train coders, inter-rater agreement was computed based on this training, and reliability was found to be 0.93. The current study was designed to focus on family visitors and the researcher attempted to understand more fully the nature of the attentional behaviors underlying specific family interactions by not only coding a parent's locus of attention, but also coding the particular parent-child interactions that were taking place.

Setting

This study was conducted at the Florida State Museum in Gainesville, Florida, the largest natural history museum in the South. The exhibits deal with concepts such as adaptation and change and present these concepts from an ecological perspective. The exhibits reflect the museum's biological and archaeological research in Florida and the Caribbean.

The museum has a maze-like floorplan, leading the visitor through a variety of exhibit galleries connected by halls. Most visitors, in particular first-time visitors, follow the same pathway dictated by this maze-like floorplan. The exhibits in these galleries vary from being static to participatory (c.f. Koran et al., 1983; Lee, 1969). This investigation focused on data collected in four of the exhibit areas described here in the order of their visitation by most visitors: a) a "Temporary Exhibit" hall filled with standard case exhibits on a potpourri of subjects; b) a walk-through exhibit depicting a Florida mesic hammock ecosystem called in this study the "Mesic Hammock Exhibit;" c) an exhibit hall, for the purposes of this study referred to as the "Behavior Exhibit," which describes the behavior of plants and animals (including man) utilizing films, standard case exhibits, small dioramas, some participatory push button displays, and audio presentations; and d) a participatory gallery called the Object Gallery, designed to display objects in a more informal and more accessible manner than in many other areas of the museum.

Instrumentation

Ethnographic data were collected earlier during the pilot study phase of this research (see Appendix 1). In the process of conducting the pilot ethnography a variety of parent-child interactions were observed. These data provided a basis for the construction of the instrument utilized in this study.

The instrument was a modified version of an instrument developed by Falk (1983a, 1983b) and is described in detail in Falk et al. (1985). The most frequently observed parent-child behaviors were added to the Falk instrument, a time-driven recording device developed at the Smithsonian Institution to allow recording of visitor locus of attention. Visitor behavior was coded into a total of five loci of attention: attention to exhibit, attention to setting, attention to own social group, attention to other social group, and attention to self.

The parent-child behaviors were recorded utilizing a "behavioral sentence" format described by Falk and Balling (1982). This format involves coding a subject, verb, and direct object that described an interaction observed. The instrument is presented in Figure 2.

The categories were based on parent-initiated behaviors, since in most families it appears that the parent

FORMAT:	____________	________	_______	________
	attention to	subject	verb	child

ATTENTION TO:

(1) exhibit
(3) setting
(5) self
(7) own social group
(9) other social group

SUBJECT:

(1) Mother
(2) Father

VERB:

(1) disciplines
(2) points out specimen
(3) points out aspect of specimen
(4) questions
(5) answers
(6) explains
(7) manages
(8) reinforces
(9) does not interact
(10) cannot tell
(11) listens to child
(12) engages in a related conversation
(13) engages in an unrelated conversation

CHILD:

(11) oldest male
(12) second oldest male
(13) third oldest male
(14) fourth oldest male
(21) oldest female
(22) second oldest female
(23) third oldest female
(24) fourth oldest female
(3) more than one child
(4) other adult
(5) child-child interactions

Figure 2. Parent-Child interaction instrument

leads the visit (Diamond, 1980; Lakota, 1975; Rosenfeld, 1980). It also became clear as the instrument was being pilot tested that it was going to be impossible to code all family member behaviors. A decision was made to focus on just one parent per family group, so a parent was selected randomly upon entering the museum and their specific attentional behaviors were recorded in detail while the child-initiated attentional behaviors were noted, but not coded in detail.

An example of coding utilizing this instrument would be as follows: (1) Mother (1) attending to exhibit (4) asks a question of the (22) second oldest daughter. Another example would be as follows: (2) Father (1) attending to exhibit (3) points out aspects of specimen to (11) oldest son. The numbers represent the category within which each rater judged a particular behavior to be contained.

Content validity was established for the instrument by a panel of educational researchers and museologists aware that attentional behaviors included in the instrument were those that families had engaged in most frequently during the original ethnographic study. Preliminary data were collected utilizing the instrument and these were used by the panel to determine the instrument's validity and to train objective observers. The panel matched observed behaviors with categories on the instrument and determined that the categories did indeed cover the realm of family visitor behavior. It was determined that the instrument did indeed validly measure attentional behavior. Thirteen separate attentional behaviors were considered relevant to the research questions: a) Parent attends to exhibit and points out an object for child; b) parent attends to exhibit and points out an aspect of the exhibit to the child; c) parent attends to exhibit and asks an exhibit-related question of child; d) parent attends to exhibit and answers a question for child; e) parent attends to exhibit and explains something exhibit-related to child; f) parent attends to exhibit and does not interact with child; g) parent attends to exhibit and listens to child; h) parent attends to exhibit and engages in an exhibit-related conversation with child; i) parent attends to setting and asks a setting-related question of child; j) parent attends to setting and answers a question for child; k) parent attends to setting and explains something setting-related to child; l) parent attends to setting and does not interact with child; and m) parent attends to setting and engages in a setting-related conversation with child.

Independent Variables

In order to study how families were interacting in free choice learning settings, it was necessary to systematically observe such groups and devise some method or methods for recording their interactions. The unique qualities of the informal learning setting experience, e.g., free choice, lack of prerequisite knowledge and credentials, heterogeneity of learner groups in background and interests, and importance of social interaction (c.f. Laetsch et al., 1980), suggested that a naturalistic approach would be most appropriate to study the variables of interest because the experimental manipulation of subjects would confound the appearance of the behaviors under observation. Also random assignment to treatment groups would have interfered with the ability to ascertain within group differences, in this particular study, as important as between group differences.

The dependent measures in this study were the frequencies of the 13 attentional behaviors. The first independent variable, exhibit type, was described utilizing the exhibit taxonomy developed by Koran, Longino, and Dierking-Shafer (1983) and Lee (1969). It was possible to place these exhibits on the continuum ranging from static to walk-through to participatory. Families were selected at random upon entering the museum, were followed as they viewed each exhibit, and their behavior coded during the course of their visit. The attentional behaviors observed at each of the designated exhibits (the first independent variable)--the "Temporary Exhibit," the walk-through "Mesic Hammock Exhibit," the "Behavior Exhibit," and the Object Gallery, were coded and utilized for analysis.

The second independent variable, a categorical independent variable, considered in this study was the family type, categorized according to the age of children in the family. In terms of attempting to analyze family behavior one of the most important differences to consider is the variation in the age of the children present. Results of research on families suggest that families with young children will have different agendas and will exhibit different behaviors in free choice learning settings than will families with older children. In families with children of young ages and older ages, the family agenda is primarily influenced by the younger children (Falk, Balling, & White, 1983). Stevenson (1972) suggested that the period between the ages three and six are transitional ones and that there are highly distinguishable cognitive differences between a three-year-old and six-year-old. These findings resulted in the researcher categorizing families into those with children of five and under, those with children over five and those with children from both of those categories.

The third independent variable of interest, once again a categorical independent variable, in this study was dyad type. Each family was labeled by the most frequent dyad combination observed during the course of its visit. There were four possible combinations: a) father-son dyads, b) father-daughter dyads, c) mother-son dyads, and d) mother-daughter dyads. Data were collected for 56 families. Thirty-five of the families contained only children over five, 12 of the families included only children five and under, and 9 of the families included children in both categories. Based on the most frequently observed dyad pairs per family, they were divided into 24 father-son dyad pairs, 11 mother-daughter dyad pairs, 16 mother-son dyad pairs, and 5 father-daughter dyad pairs.

Data Collection Procedures

Reliability

The major portion of the data collection was to be conducted by the researcher and, consequently, it was necessary to determine inter-rater reliability of the instrument to ensure that this aspect of the design would not endanger the reliability of the data collected. Two observers (the researcher and one technician) observed 15 families in each of the four exhibits and generalizability theory was used to test inter-rater reliability among this subset of the families (Cronbach, Gleser, Nanda, & Rajaratnam, 1972; Schomaker & Knopf, 1982). This analysis was conducted to determine the effects of different coders observing the same 15 families in each of the four exhibits. The results of this analysis would indicate whether the instrument would be likely to produce reliable results, irrespective of which coder used it or which exhibit was being observed. If the reliability coefficients computed were within acceptable ranges, it would indicate that the researcher's coding was consistent with other coders, regardless of which exhibit she was observing, and therefore, there was no measurement bias in having the data primarily collected by her.

Data Collection

The procedures utilized in this study required minimal materials. A timer, the size of a pocket calculator, with an earphone attached was carried by the observer. This timer made a clicking noise every five seconds, designating when the researcher needed to record what he/she was observing on a data sheet. A computer-generated data sheet was used for recording observations. The protocol for data collection is presented in Appendix 2. A coding system which was described in greater detail in the instrumentation section was utilized to simplify recording.

Except during the reliability phase of the study when two research technicians collected data with the researcher, all data were collected by the author. Most of the data were collected on weekends because that is when families most frequently visit informal learning settings (National Endowment for the Arts, 1974). A sample of 56 families was selected randomly as they entered the museum. Each family was observed throughout its visit, and when the researcher returned to the lobby, she waited for the next family to appear.

A "family" group was defined as a social group containing at least one child, but containing no more than four adults and no more than five children. Determination of kinship was not a requisite criterion, but observation and subsequent interviews indicated that all but 2 of the 56 families were related. As a family entered the museum, the

the family members were greeted by a researcher and were asked if they minded being followed and observed. If granted permission, the researcher began following the family, attempting to be as unobtrusive as possible. During the pilot testing of the instrument, the researcher found no problem in asking permission at the beginning of the visit. Most groups forgot that anyone was following them. However, if one did not ask permission, the groups seemed to constantly be bothered by the attention they were receiving so permission was received apriori for each of the groups.

If only one parent was present in a group, that parent's attention behavior was coded. If two parents were present, the researcher selected one to observe, generally alternating the sex of the chosen parent. The desire was to have equal numbers of males and females in order to analyze the data for sex differences and tallying at the end of each period of observation confirmed that this selection procedure was resulting in relatively equal groups.

The family was followed throughout their visit; location was noted and each five seconds the major interaction occurring in the preceding time frame was recorded. The observer recorded the parent's locus of attention and the parent-child interaction they were engaged in on the data sheet. After the data sheet was completed the researcher awaited the next family and repeated the procedure.

Data Analysis

The coded data were tabulated and behavior frequencies, normalized for time spent in the exhibit, were calculated for each family. Families' behavior frequencies were also grouped according to the most common dyad combinations observed. Frequencies were tabulated for a male parent with a male child five or under, a male parent with a male child over five and a male parent with a male child and children of mixed ages. Likewise, frequencies for a male parent with a female child in all the above categories were tabulated. Female parent dyads (with male and female children respectively) were similarly tabulated. This tabulation enabled the researcher to identify behaviors occurring most frequently and requiring further analysis.

Utilizing the behavior frequencies tabulated above, separate 4 (exhibit type) X 3 (family type) X 4 (dyad type) analyses of variance (ANOVA) with repeated measures on the first factor were performed on the 13 attentional behaviors identified earlier in this chapter to determine whether main effects existed and also whether the combined influence of the three independent variables had produced significant effects on the occurrence of these separate attentional behaviors. It is important to note here that the research hypotheses for this study were stated in a directional form. However, the design had multiple factors with multiple levels for the exhibit factor. The appropriate analysis for this design inherently tested two-tailed statistical hypotheses and in interpreting the resulting statistics generated when testing the research hypotheses the direction of mean differences was taken into account. That is, if the test was significant, but the direction was contrary to that hypothesized it was noted in the discussion. If significant differences were found ($p < .05$) after performing these analyses, appropriate Bonferroni pairwise contrast tests were performed to determine the specifics of these differences. If interactions resulted, these results were plotted in order to graphically represent the trends.

CHAPTER 4
RESULTS

Reliability Analysis

The reliability data were normalized for time spent in the exhibit hall and the following equation was used to compute a generalizability coefficient (ρ^2) for each behavior:

$$\rho^2 = \frac{\sigma_F^2}{\sigma_F^2 + \sigma_{FR}^2 + \sigma_E^2}$$

where σ_F^2, σ_{FR}^2, and σ_E^2 are variance components for families, the family by rater interaction, and error, respectively. The variance components and generalizability coefficients appear in Table 1. The generalizability coefficients range from 0.66 - 1.0 on a 0 - 1 scale, suggesting that within an exhibit the behavioral frequencies, contributed by two raters (coders), are substantially correlated.

Repeated Measures ANOVA Analysis

Data were collected for 56 families. Behavior frequencies, normalized for time spent in the exhibit, were calculated for each family. Those raw data frequencies are reported in Appendix 3. Families' behavior frequencies were

Table 1
Variance Components and Generalizability Coefficients for Reliability Analysis

Behavior	Variance Components				Generalizability Coefficient
	σ_F^2	σ_{FR}^2	σ_{FL}^2	σ_E^2	
Exhibit-related pointing	1.62	0.00	19.96	0.13	0.93
Exhibit-related pointing out aspect of object	0.83	0.00	0.83	0.01	0.88
Exhibit-related questioning	1.98	0.00	4.38	0.07	0.97
Exhibit-related answering	0.13	0.32	0.00	0.00	1.00
Exhibit-related explanation to child	3.32	0.00	17.94	0.10	0.97
Exhibit-related non-interaction	63.47	0.00	260.47	0.22	0.99
Exhibit-related listening	0.32	0.00	35.19	0.14	0.71
Exhibit-related related conversation	11.94	0.00	64.81	0.30	0.98
Setting-related questioning	13.81	0.02	41.73	1.26	0.92
Setting-related answering	0.52	0.00	0.54	0.00	1.00
Setting-related explanation	2.49	0.00	11.70	0.02	0.99
Setting-related non-interaction	0.09	0.00	0.16	0.01	0.89
Setting-related related conversa.	0.13	0.00	1.17	0.07	0.66

also grouped according to the most common dyad combinations observed. Those raw data frequencies appear in Appendix 4.

Separate 4 (exhibit type) X 3 (family type) X 4 (dyad type) analyses of variance (ANOVA) with repeated measures on the first factor were performed on the 13 attentional behaviors identified in Chapter 3. Significant results were observed for 4 of the 13 attentional behaviors. For both questioning variables (exhibit, setting) significant three-way interactions were obtained indicating that the effect of exhibit type, family type, and dyad type was quite complex. A significant three-way interaction was also obtained for one of the two explanation variables (setting). Summaries of these three analyses are reported in Tables 2, 3, and 4. A significant main effect for exhibit type was obtained for the exhibit non-interaction variable. The result of that analysis is reported in Table 5. Means for the non-interaction variable at each of the exhibits are reported in Table 6. The nine ANOVAs which did not result in significant test statistics are contained in Appendix 5.

The significant three-way interactions resulting for exhibit-related questioning, setting-related questioning,and setting-related explanation suggest that, for these three variables, the joint influence of any two levels of exhibit type, family type, and dyad type depends on the level of the third variable. Consequently, two-way interactions and main effects are not interpreted.

Table 2
Repeated Measures ANOVA--Exhibit-Related Questioning

Source	df	Type III SS	MS	*F*	PR > F
Between					
Family type (F)	2	0.56	0.28	5.89	0.006*
Dyad type (D)	3	0.32	0.11	2.28	0.096
F X D	5	1.33	0.27	5.62	0.0007*
Error	35	1.66	0.05		
Within					
Exhibit type (E)	3	0.11	0.04	1.14	0.33
E X F	6	0.64	0.11	3.45	0.004*
E X D	9	0.61	0.07	2.18	0.03*
E X F X D	15	0.96	0.06	2.06	0.02*
Error	105	3.27	0.03		

Huynh-Feldt epsilon = 1.00
* $p < 0.05$

Table 3
Summary Repeated Measures ANOVA--Setting-related questioning

Source	df	Type III SS	MS	*F*	PR > F
Between					
Family type (F)	2	0.002	0.001	3.28	0.0497*
Dyad type (D)	3	0.003	0.001	3.57	0.02*
F X D	5	0.004	0.001	2.90	0.03*
Error	35	0.01	0.0003		
Within					
Exhibit type (E)	3	0.003	0.008	3.37	0.046*
E X F	6	0.006	0.001	3.76	0.01*
E X D	9	0.007	0.0008	3.02	0.02*
E X F X D	15	0.01	0.0008	3.30	0.003*
Error	105	0.03	0.0003		

Huynh-Feldt epsilon = 0.59
* $p < 0.05$

Table 4
Summary Repeated Measures ANOVA--Setting-Related Explanation

Source	df	Type III SS	MS	*F*	PR > F
Between					
Family type (F)	2	0.04	0.02	4.76	0.02*
Dyad type (D)	3	0.04	0.01	3.30	0.03*
F X D	5	0.05	0.01	2.71	0.04*
Error	35	0.14	0.004		
Within					
Exhibit type (E)	3	0.03	0.01	4.59	0.02*
E X F	6	0.05	0.01	3.50	0.01*
E X D	9	0.07	0.01	3.49	0.01*
E X F X D	15	0.11	0.007	3.25	0.002*
Error	105	0.24	0.002		

Huynh-Feldt epsilon = 0.62
* $p < 0.05$

Table 5
Summary Repeated Measures ANOVA--Exhibit-Related Non-Interaction

Source	df	Type III SS	MS	*F*	PR > F
Between					
Family type (F)	2	14.08	7.04	0.40	0.67
Dyad type (D)	3	41.26	13.75	0.79	0.51
F X D	5	13.68	2.74	0.16	0.98
Error	35	611.70	17.48		
Within					
Exhibit type (E)	3	99.60	33.20	6.28	0.0006*
E X F	6	22.00	3.67	0.69	0.66
E X D	9	37.94	4.22	0.80	0.62
E X F X D	15	53.19	3.55	0.67	0.80
Error	105	555.48	5.29		

Huynh-Feldt epsilon = 1.00
* $p < 0.05$

Table 6

Means for Exhibit-Related Non-Interaction for Each Exhibit

Exhibit	Means	SD
Temporary Exhibit	2.28	1.96
Mesic Hammock	4.51	2.33
Behavior Exhibit	4.48	1.93
Object Gallery	4.23	1.81

The graphs of the three-way interaction for exhibit-related and setting-related questioning are displayed in Figures 3a, 3b, 3c, 4a, 4b, and 4c, respectively. Graphs of the three-way interaction for the setting-related explanation are reported in Figure 5a, 5b, and 5c respectively.

Figure 3a represents the frequency of exhibit-related questioning per exhibit for each dyad type for families with children five-years-old or younger. The frequency of this behavior for father-son dyads is fairly consistent from exhibit to exhibit, with a slight rise at the "Behavior Exhibit." In marked contrast, the frequency of this same behavior for father-daughter dyads is zero, indicating that fathers did not engage in this behavior at all with young daughters.

The frequency of exhibit-related questioning for mother-son dyads is zero while at the "Temporary Exhibit" and "Hammock," rising to its peak at the "Behavior Exhibit"

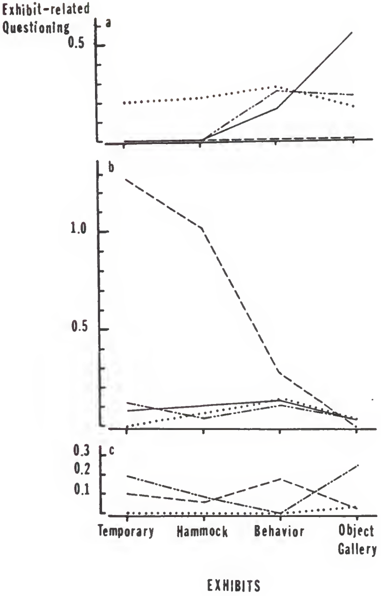

Figure 3. Frequency of exhibit-related questioning per exhibit for each dyad type.[1] a) Families with children five-years-old or younger; b) Families with children over five-years-old; c) Families with children in both age groups.

1. Dyad types

· · · · · · · Father-son dyads
— — — Father-daughter dyads
—— - - —— Mother-son dyads
———— Mother-daughter dyads

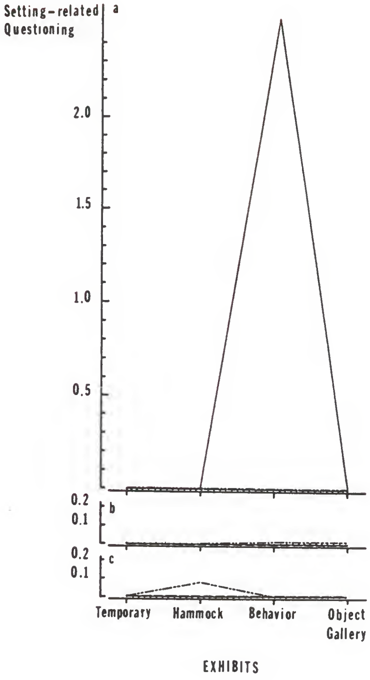

Figure 4. Frequency of setting-related questioning per exhibit for each dyad type.[1] a) Families with children five-years-old or younger; b) Families with children over five-years-old; c) Families with children in both age groups.

1. Dyad types

. . . . Father-son dyads
___ ___ ___ Father-daughter dyads
____ _ _ ___ Mother-son dyads
___________ Mother-daughter dyads

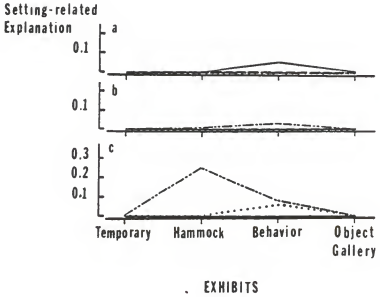

Figure 5. Frequency of setting-related explanation per exhibit for each dyad type.[1] a) Families with children five-years-old or younger; b) Families with children over five-years-old; c) Families with children in both age groups.

1. Dyad types

. . . . Father-son dyads
— — — Father-daughter dyads
—— - - —— Mother-son dyads
———— Mother-daughter dyads

and then declining in the Object Gallery. In contrast, the frequency of this same behavior for mother-daughter dyads indicates a gradually rising plot, peaking at the Object Gallery. For the two mother dyads the graphs of the frequencies are similar except at the "Behavior Exhibit." There the frequency of the behavior is higher for mother-daughter dyads than for mother-son dyads.

Figure 3b represents the frequency of exhibit-related questioning per exhibit for each dyad type for families with children over five-years-old. The frequencies of this behavior for father-son-dyads, mother-son dyads, and mother-daughter dyads are similar. However, the plot for father-daughter dyads is decidedly different, with a very high frequency of exhibit-related questioning at the front end of the visit ("Temporary Exhibit," "Hammock") and decreasing to zero at the Object Gallery.

Figure 3c represents the frequency of exhibit-related questioning per exhibit for each dyad type (except for mother-daughter dyads which was an empty cell for this family type) for families with children in both age groups. The frequency of this behavior for father-son dyads is essentially zero, while for father-daughter dyads it is relatively flat, peaking slightly at the "Behavior Exhibit." The frequency of this behavior for mother-son dyads is relatively high at the "Temporary Exhibit," declining at the "Hammock" and the "Behavior Exhibit" and finally peaking at the Object Gallery.

Figure 4a represents the frequency of setting-related questioning per exhibit for each dyad type for families with children five-years-old or younger. All graphs are flat, at zero, except for the frequency of this behavior for mother-daughter dyads. There is a very steep increase in frequency for this behavior at the "Behavior Exhibit."

Figure 4b represents the frequency of setting-related questioning per exhibit for each dyad type for families with children over five-years-old. All plots represent zero frequency for this behavior at each exhibit.

Figure 4c represents the frequency of setting-related questioning per exhibit for each dyad type (except as mentioned previously, mother-daughter dyads) for families with children in both age groups. This behavior did not occur for father-son dyads and father-daughter dyads. There was a slight increase in the frequency of this behavior for mother-son dyads at the "Hammock;" however its frequency was zero at other exhibits.

Figure 5a represents the frequency of setting-related explanation per exhibit for each dyad type for families with children five-years-old or younger. This behavior was not observed for father-son dyads, father-daughter dyads, and mother-son dyads. There was a slight increase in its frequency for mother-daughter dyads at the "Behavior Exhibit;" however, its frequency was zero at other exhibits.

Figure 5b represents the frequency of setting-related explanation per exhibit for each dyad type for families with children over five years of age. This behavior did not occur for father-son dyads, father-daughter dyads, and mother-daughter dyads. There was a very slight increase in this behavior for mother-son dyads at the "Behavior Exhibit;" however, its frequency was zero at other exhibits.

Figure 5c represents the frequency of setting-related explanation for each dyad type, except for mother-daughter dyads, for families with children in both age groups. The behavior did not occur for father-daughter dyads. The frequency of the behavior for mother-son dyads was such that it was zero at the "Temporary Exhibit," increased at the "Hammock," then decreased at the next two exhibits. The frequency of this behavior for father-son dyads was such that it increased slightly at the "Behavior Exhibit;" however, its frequency was zero at the other exhibits.

As indicated in Table 5, there was a main effect for exhibit type for the exhibit-related non-interaction variable. This behavior was observed when a parent was directing his or her attention at the exhibit and not interacting with a child. One can see by looking at the means in Table 6 that this behavior occurred most frequently when families were at the more participatory exhibits. This occurred most frequently in the "Hammock Exhibit" and the "Behavior Exhibit," followed by the Object Gallery. It occurred least in the "Temporary Exhibit." Pairwise comparisons using Bonferroni critical values were computed for each of the contrasts. The frequency of this non-interaction variable at the "Temporary Exhibit" was found to be significantly less than at the "Hammock" ($t = -4.365$, $p < .05$). The frequency of this behavior at the "Temporary Exhibit" was also found to be significantly less than at the "Behavior Exhibit" ($t = -5.807$, $p < .05$). The frequency of this behavior was also found to be significantly less at the "Temporary Exhibit" than at the Object Gallery ($\underline{t} = -5.612$, $\underline{p} < .05$). The latter three Bonferroni critical values computed were not significant.

In summary, significant results were observed for 4 of the 13 attentional behaviors. For both questioning variables (exhibit, setting) significant three-way interactions were obtained indicating that the effect of exhibit type, family type, and dyad type was quite complex. It would be impossible to predict the effect of any two variables without knowing specifics about the third variable. A significant three-way interaction was also obtained for one of the two explanation variables (setting). A significant main effect for exhibit type was obtained for the exhibit non-interaction variable, with frequencies higher for that behavior when families were at the more participatory exhibits.

CHAPTER 5
DISCUSSION

It will be recalled that the present investigation was designed to explore the following questions: a) Do certain types of exhibits elicit more attentional behaviors than others? b) Do the frequencies of attentional behaviors vary as a function of family type? c) Do the frequencies of attentional behaviors vary as a function of dyad type?

Relevant research suggested the following hypotheses:

Exhibit Type

Hr_1 It was hypothesized that exhibit characteristics would influence the occurrence of attentional behaviors. The more an exhibit provided opportunities for touching, manipulating, and "experiencing" the objects and concepts presented, the more attentional behaviors would be observed.

Family Type

Hr_2 It was hypothesized that attentional behaviors would vary as a function of the age of children in the family, and therefore, families with older children were expected to exhibit more attentional behaviors than families with younger children or families with a combination of ages.

Dyad Type

Hr_3 Attentional behaviors were expected to vary as a function of the sex of parent-child pairs such that it was hypothesized that fathers and mothers would be more likely to engage in attentional behaviors related to the exhibits and the setting of the free choice learning environment with sons than with daughters.

Hypothesis 1: Differences in Attentional Behavior as a Function of Exhibit Type

It was hypothesized that differences in attentional behavior would be observed as a function of exhibit type. This hypothesis was supported by the data, in particular, for the questioning behaviors and for the explanation variable. Seven of the nine graphs (Refer to Figure 3a, 3c, 4a, 4c, 5a, 5b, and 5c) indicate, for some of the plots, that questioning and explanation behaviors increased in frequency along the continuum of exhibit type, with more of the behavior occurring in one instance in the walk-through Hammock Exhibit," in other instances more occurring in the "Behavior Exhibit" and the Object Gallery. As hypothesized it seemed that the more an exhibit provided opportunities for touching and manipulating, the more attentional behaviors associated with cognitive processing activities such as questioning and explanation occurred. The static exhibits showed consistently low frequencies of these behaviors. There was one exception; father-daughter dyads with children over five-years-old exhibited higher frequencies of exhibit-related questioning when interacting with static exhibits. The one main effect for exhibit type occurred for the exhibit-related non-interaction variable, indicating the parent's attention to exhibit. This was occurring also along the same continuum; parents were more likely to engage in this behavior in the more participatory exhibits ("Hammock," "Behavior Exhibit," and Object Gallery) and less likely in the static exhibit ("Temporary Exhibit").

More careful analysis of the three-way interaction findings, however, demonstrates the complexity of attempting to understand the museum visitor experience. In all instances results were dependent on knowing information about outcome variables, characteristics of visitors, visitor processing activities, and the characteristics of the exhibits being studied. It was impossible to examine the outcome variables (frequency of the attentional behavior observed) with any degree of accuracy without considering the characteristics of the exhibit, the characteristics of the visitor, and his/her concomitant cognitive processing strategies.

For example, the exhibit where setting-related questioning occurred more frequently than any of the other behaviors was in the "Behavior Exhibit" for mother-daughter dyads. When interacting with the "Behavior Exhibit," with its unique characteristics, certain visitors (mother-daughter dyads) engaged in high frequencies of setting-related questioning (both an outcome variable and a visitor processing activity). Why was such a high frequency of the outcome variable setting-related questioning observed in the "Behavior Exhibit?" And why was this high frequency observed only for mother-daughter dyad pairs? Why would exhibit-related behavior be a more frequent outcome variable in the Object Gallery for most dyad types?

In a study conducted by Koran, Koran, and Longino (1986) these researchers suggested that opportunities to inspect objects up close, to perhaps even manipulate them, enhanced attention and curiosity behavior. In the Object Gallery this was occurring, but why not also in the "Behavior Exhibit," with its push button displays, videotapes, and headphones for listening to audio presentations?

The Object Gallery looks a great deal like a library, with a card catalog-like drawer area in a semi-circle surrounded on the outside walls by static display cases. The room is actually very low key, allowing the objects to be the focus. By contrast, the "Behavior Exhibit" is an L-shaped hall area filled with small dioramas, films, some participatory push button displays, and audio presentations. There is an air of activity to this space; visitors appear to be stimulated by the wealth of sights and sounds. In such a space, exhibit variables seemed to elicit visitor behavior differences in the area of "setting attention" rather than "exhibit attention."

It is likely that the "Behavior Exhibit," with all of its options, made it difficult to attend to specific artifacts. Characteristics of the "Behavior Exhibit," such as the push buttons, audiophones, and other technologies, may have actually drawn attention away from the instructional content of the exhibit. Attention was directed toward the setting but not individual exhibits. Such environmental diversity can be confusing to the visitor. As suggested in the literature review, attention does appear to be a limited phenomenon, the more attention paid to one cue, the less available for other cues (Bransford, 1979; Egeth, 1967; Kahneman, 1973). Both Nahemov (1971) and Danilov (1979) emphasized that in such multidimensional environments visitors have difficulty focusing their attention and remaining attentive long enough for information processing to occur. Perhaps this was the phenomenon occurring in the "Behavior Exhibit."

One could also question how many options are actually provided by the "Behavior Exhibit." There is a great deal of technology provided, but actually very few options outside of the button pushing. There are many more options provided in the Object Gallery with its drawers to pull out, objects on display for touching, and books for reference. One characteristic of the Object Gallery is that it actually is much more of a "free choice" space than the "Behavior Exhibit." Because of this characteristic, the Object Gallery may provide more motivation and opportunity to act upon one's curiosity, possibly prompting further coding and recall of elements in memory, and thus engaging the parent and child in more exhibit-related questioning.

Why would this behavior occur so frequently for mother-dyad pairs and not for the other pairs? One might speculate that perhaps it was the result of one mother-daughter pair that for some reason engaged in high frequencies of this behavior. A look at the data did not support this explanation.

This high frequency could be explained by suggesting that what is being observed here is a sex difference phenomenon. Many aspects of this exhibit space involve technology, and researchers suggest that females are often socialized to deal with technology in different ways than males (Skolnick, Langbort, & Day, 1982). These results may indicate an interaction between characteristics of the visitor (sex) and characteristics of the exhibit. However, great technological expertise is not required to push buttons and listen to audiotapes so that seems unlikely as well. What is important about this finding is that it demonstrates the complexity of attempting to understand the museum visit. In this particular situation, it is impossible to analyze the outcome variable (frequency of setting-related questioning observed) without considering the characteristics of the exhibit ("Behavior Exhibit") and the characteristics of the visitor (dyad type). The outcome variable, questioning, is also an important visitor processing activity further demonstrating the complexity of such research.

Why would families' attentional behavior associated with questioning be sensitive to differences in exhibit characteristics? Questioning has historically been considered an important variable in classroom interaction/learning studies (Rowe, 1974; DeTure, 1979; Koran, 1972; Koran, Koran, & Freeman, 1976) and it may likewise be a crucial variable to consider when analyzing family museum behavior. Certainly the complexity of content presented in a free choice learning setting varies from exhibit to exhibit as does the novelty of the artifacts and the number of senses required to attend to this rich environment. Introduce into this equation the effects of characteristics of visitors with their varying levels of cognitive processing ability and it is not surprising that significant differences in questioning behavior resulted.

Obviously, clear goals and objectives need to be stated by the researcher studying learning in such settings or by the museum professional designing exhibits. These goals and objectives need to be very specific, addressing the particular exhibit and its characteristics, the particular type of visitors involved, the type of processing activities anticipated, and the desired outcomes. Is the researcher attempting to measure cognitive learning of content contained within an exhibit or more interested in determining attitudinal changes? Is the designer trying to convey specific information on a particular topic or trying to create a sense of how an environment feels? The process of stating clear goals and objectives helps to clarify these issues for the individual, whether researcher or designer. The results of this particular study suggest that the questions stated above are very different and require the consideration of different types of variables and, in fact, likely involve interactions complicating the research and exhibit designs.

Hypothesis 2: Differences in Attentional Behaviors as a Function of Family Type

It was hypothesized that families with children over five-years-old would engage in more attentional behaviors than those families with children five-years-old or younger or families with children in both age groups. It was felt that older children's cognitive processing abilities were more developed and that they also were more likely to have had experiences in museums, reducing the novelty effects that might influence younger children. Consequently, attention could be focused in a variety of attentional behaviors.

By noting the graphs for families with children five-years-old or younger in Figures 3a, 4a, and 5a as compared to those for the other families in 3b, 3c, 4b, 4c, 5b, and 5c it is evident that this hypothesis was not supported. The researcher found that, with the instrument utilized in this study, exhibit-related questioning behavior was just as frequent or more frequent for families with children under five-years-old. This instrument was not designed to distinguish between different types of questions; concrete versus abstract, low level versus high level. There may have been a difference in the type of questions asked of young children versus older children. Since questioning was a consistent, though not overwhelmingly significant variable in this study, further research designed to analyze different levels of family questioning in more detail should be conducted. It is possible that by focusing solely on different levels of questioning, the results might be less equivocal.

Exhibit-related questioning was one attentional behavior affected by family type. An interaction was observed in this analysis when families had children five-years-old or younger or children falling into both age groups; see Figures 3a and 3c. The trend for these families was such that this behavior increased for these families rather than decreasing through the course of the visit. It is also interesting to note that the dyads exhibiting this increase in Figure 3a are mother-daughter dyads and in Figure 3c they are mother-son dyads. Once again, these findings require simultaneous consideration of the four categories of variables (visitor characteristics, exhibit characteristics, visitor processing activities, and desired outcomes) in order to be useful at all.

For example, utilizing the Koran and Koran (1986) model, one can speculate as to why exhibit-related questioning increased during the course of the visit for families with young children and families with children in both age groups. One possible explanation relates to the novelty research cited in the literature review. Younger children may not be as accustomed to museums because of fewer family and school trips in their experience and, unlike families with older children who may have more experience, be less able to begin task-oriented exhibit-attending behaviors immediately upon entering the museum. Thus, a visitor characteristic (novelty level) could be interacting with both the characteristics of the exhibits, in this case, the museum as a whole, and also with visitor processing activities and desired outcomes. This explanation seems to be supported by the data. Falk (1983b) and Falk, Martin, and Balling (1978) indicated that novelty effects may interfere to a large degree with information processing activities, thus decreasing attention, and resulting in reduced cognitive learning. Parents, many of whom were observed trying to look at exhibits in an attentive fashion while also attending to the needs of young children, may have taken the opportunity to look at the exhibits themselves, rather than asking questions of their child. The results indicating a low mean for exhibit-related non-interaction at the "Temporary Exhibit" (See Table 6) would suggest that this phenomenon was not occurring. Parents may have been engaging in some other activities, perhaps assisting the child in orienting to the museum space.

Another possible approach to understanding these frequencies, again utilizing the Koran and Koran (1986) model, pertains to the characteristics of the exhibits and concomitant cognitive levels of the children in the families (visitor characteristics). Both the "Behavior Exhibit" and the Object Gallery are exhibits containing concrete objects or depicting concrete activities of plants and animals. The "Behavior Exhibit" has a series of exhibit cases at a child's eye level, depicting feeding, fighting, and other concrete behaviors of animals. There are also audiotapes of animal sounds. The Object Gallery has concrete objects, shells, bones, and clothing for example. Some of these objects can be touched and manipulated by the visitor. The "Temporary Exhibit" and the "Hammock" to some extent are not as concrete as the other two exhibits. They also contain objects, but these are in cases, often with only a label to provide meaning to them. Most children in the five and younger group are probably not readers. Since readability levels for most of the exhibits at the Florida State Museum range between a seventh and ninth grade level (Dunckel Camp, personal communication, 1983) indicating that unless the parent is reading labels to the child or in some other way interpreting the exhibit for them they may be having difficulty doing so themselves. In the "Behavior Exhibit" and Object Gallery they are able to overcome these shortcomings because of the concrete concepts and in the Object Gallery because of the opportunities to touch and manipulate. Under those conditions one would expect children to ask more questions.

The more abstract the exhibit, such as the "Temporary Exhibit" (standard case exhibit) requiring the child (or their parent) to read, encode, and process the abstract information contained within it, the more difficult the task for the child five and younger, but the easier the task for older children and adults. One might have anticipated higher frequencies of questioning to result in these static displays for that reason; however, graphs in Figure 3a and 4a do not support that notion. The child may have been so overwhelmed by the encoding and processing requirements that attention could not be focused, resulting in fewer attentional behaviors.

Obviously, a key factor here is the ability of the child to utilize verbal mediators and, therefore, to encode and process abstractions (Stevenson, 1972). Researchers have suggested that the period between the ages of three and six appears to be a transitional one for a child (Kendler, 1963; Kendler & Kendler, 1959; Kendler, Kendler, & Wells, 1960; Kuenne, 1946; Spiker, Gerjuoy, & Shepard, 1956, Stevenson, 1972). This transitional period is when a child becomes verbally sophisticated and capable of utilizing verbal mediators. During very early childhood a simple language has been acquired, but it is very concrete-based, requiring seeing, tasting, hearing, or touching the object. Around the ages of four to six most normal children appear to develop the capacity to use words as abstract designations of the physical world that are capable of directing the course of their behavior. Merely knowing words is insufficient; the two- and three-year-old may know the words but be unable to relate them to action. Not until around the age of six are most children, by themselves, capable of seeing the relation between what is said and what they must do, between an abstraction and the reality it represents. Through the use of language the child gains independence from the characteristics of a particular setting, he learns more readily, and is able to transfer this learning over a broader range of situations. These factors certainly may have contributed to the differences in questioning with respect to age.

Differences were observed between families with children probably unable to utilize verbal mediators, and families with children who were probably able to do so. As mentioned earlier in the study as an anticipated circumstance, those families with a combination of ages were most likely operating at the level of the younger children. Certainly, it would be difficult for a child not verbally facile to analyze, synthesize, and encode information about an unfamiliar object in a case exhibit.

Another variable that enters into the explanation relates to the research regarding young children's differential attention to color and shape. In the review of literature, the role of attention in children's learning of science concepts (Koran & Lehman, 1981) was discussed. In that article it was emphasized that children had to focus their attention on the relevant characteristics of the objects or events used in the teaching in order for learning to occur. Depending on the child's age, color was found to aid in directing attention for younger children, while shapes tended to be more compelling for older children.

Both color and shape apparently stimulate attention and curiosity, and yet museum designers freely use combinations of these to produce an artistic or dramatic effect, often without thought regarding their effects on learning of different age groups. It is possible that these findings are a result of such an attention effect illustrating once again the interaction that exists among categories of the aforementioned model. In this particular example, visitor processing activities (attention behaviors, encoding) possibly are affected by characteristics of the visitor (family type) such that one would anticipate that the desired outcomes would differ significantly depending upon the age of the children in the family. Exhibit type also is a consideration here. Are there colors or shapes that are a part of the exhibit design that are also interacting with the child's attentional levels? Such issues reinforce the value of the Koran and Koran (1986) model, allowing for the simultaneous consideration of variables.

Hypothesis 3: Differences in Attentional Behavior as a Function of Dyad Type

It was hypothesized that fathers and mothers would be more likely to engage in attentional behaviors related to the exhibits and the setting of the free choice learning environment with sons than with daughters. The findings did not support the hypothesis that parents would engage in more attentional behaviors when paired with sons than daughters. Seven of the graphs indicate an Exhibit Type X Family Type X Dyad Type effect (refer to Figures 3a, 3b, 3c, 4a, 4c, 5a, and 5c) but once again no trend emerged allowing one to make unequivocal statements regarding sex differences. Each of the dyads, except for fathers paired with daughters five-years-old or younger, engaged in relatively high frequencies of questioning or explaining when interacting with at least one type of exhibit.

This hypothesis was based on the Diamond (1980) and Rosenfeld (1980) studies which analyzed the difference between father-son pairs and mother-daughter pairs. These researchers had not analyzed data collected for father-daughter pairs and mother-son pairs and it was thought that this addition would provide some new insights. The results from this study did provide some additional information suggesting that the effects of dyad type are, perhaps, less straightforward than originally thought. It is essential that one consider not only the sex of parent and child, but also the characteristics of the exhibit, the individuals' cognitive processing capabilities,and the desired outcomes.

With the present data it is impossible to know whether the nature of the questions were similar from daughters to sons or whether they differed in content or difficulty. As suggested earlier, further study in this area could concentrate on analyzing different levels of questions to determine the effects of age and sex on the levels of questions asked by parents.

These findings also differ from the results of the recent study of McManus (1987) in which she found that the nature of the social situation very much dictated the behaviors in which women would engage. McManus analyzed detailed conversation protocols and it is possible that these revealed differences not discernible in this study.

Conclusion

In this study the researcher attempted to determine factors that enhance attentional behavior for family visitors in a free choice learning setting. The framework utilized (see Figure 1) required the simultaneous consideration of four categories of variables:
a) characteristics of the visitors, b) visitor processing activities, c) characteristics of exhibits, and
d) desired outcomes. The researcher attempted to do this by the careful selection of independent and dependent

variables. Two of the independent variables, age of children in the family (family type) and the sex of parent-child pairs (dyad type), were related to the characteristics of the visitors' category. The other independent variable, exhibit type, reflected the characteristics of exhibits' category. The dependent variables, a variety of attentional behaviors, were all related to the visitors' processing activities as well as being desired outcomes. There was a strong feeling on the part of the researcher that simultaneous consideration of these four variable categories would be essential to the understanding of the research questions. And indeed, the findings utilized to test any of the hypotheses required simultaneous consideration of visitor processing activities, characteristics of exhibits, characteristics of visitors, and desired outcomes to be interpreted and only were relevant when qualified.

Significant results were obtained for 4 of the 13 attentional behaviors. For both questioning variables significant three-way interactions were obtained, indicating that the effect of exhibit type, family type, and dyad type on questioning is quite complex. A significant three-way interaction was also obtained for one of the two explanation variables. A significant main effect for exhibit type was obtained for the non-interaction variable. It should be noted that three of these behaviors, the questioning and explanation variables, are considered important cognitive processing activities, even though in this particular study there was a desire to consider them outcome variables. Their significance in this study, among a myriad of possible behaviors (thirty in the original raw data), demonstrates that information processing is an important activity in which museum visitors engage.

These results reinforce the necessity of considering such variable categories simultaneously when attempting to understand visitor behavior in free choice learning settings. None of the variables could be studied in isolation. Some dyad types engaged more frequently in certain processing activities depending upon the characteristics of the exhibit with which they were interacting. All of the findings required such explanations. Those variables determined to be significant in this study had a profound influence on the resulting questioning behavior (both a visitor processing activity and an outcome variable) between parents and children in a family. Likewise, the sex of parent-child pairs (characteristics of visitors) appeared to affect attentional behaviors associated with questioning depending upon the exhibit that they were viewing.

This study also utilized generalizabilty theory for one of the first times in research in free choice settings to determine the inter-rater reliability of the instrument used to collect the data. This procedure provided some very useful information regarding the reliability of the instrument. Not only was the researcher able to discuss its reliability, but it could be discussed irrespective of which coder utilized it or which exhibit was being observed. The additional information provided enabled one to be far more confident of the results obtained. This procedure alone suggests a new way to conceptualize and analyze instruments in free choice settings and should prove invaluable in providing new insights into research methodologies and instrumentation.

As suggested above, the simultaneous consideration of variables is essential when studying visitor behavior in informal settings, designing exhibits, or attempting to train parents to maximize their family's museum experience. It will be important for the museum to design exhibits with these results in mind and to assist families in utilizing exhibits in ways that will maximize their experience.

If questioning behaviors are as important as this researcher suggests, exhibit adjuncts that guide or require families to engage in questioning or provide sample questions for various age groups are a possibility. The museum can take an active role in "educating" families about how to ask good questions in free choice learning settings or actually provide questions to visitors which focus attention on specific exhibits. Educating parents to maximize their children's (particularly elementary age) informal learning experience is one important role that these institutions can perform. Information making parents aware of how their questioning behavior is affected by the age and sex of their child and "teaching" them how to involve each child, regardless of age or sex, in focusing attention and questioning activities, could be provided in workshops or via labels or pamphlets in the exhibit areas. These activities could provide a wonderful service to families visiting the free choice learning setting, but also would provide rich opportunities for conducting research regarding family learning. Labels cuing parents on how to present information to children and on how to "look" at exhibits are being utilized by some museums (Wolf-Tymitz, 1986), but systematic research focusing on the subsequent behavior of families, considering their age and sex configurations in relation to a variety of labels, is not being conducted. It would be interesting to conduct some comprehensive studies to determine the effects of different types of questions and presentations on family behavior as a function of age and sex.

Finally, the study of visitor behavior in free choice settings, particularly that of families, is still in its infancy. In this study the researcher attempted to utilize the Koran and Koran (1986) model to systematically investigate the attentional behaviors observed within families. The researcher suggests that an important category of interactions to consider when analyzing family free choice setting behavior is the category of family questioning behavior. In fact, this researcher would suggest that concentrating efforts on studying questioning behaviors would probably yield invaluable information regarding the interaction and learning of families in free choice settings. It is hoped that the findings contribute to theory regarding the complexity of family behavior, to the utilization of generalizability theory as an analytical tool in free choice settings, and provide insights to museum professionals designing exhibits and programs for families.

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APPENDIX 1
DESCRIPTION OF PILOT ETHNOGRAPHY

In a preliminary ethnographic study conducted in the Object Gallery of the Florida State Museum the researcher proposed that families could be categorized into the following three types: a) educative; b) neutral; and c) rule-enforcing.

Groups led by educative parents seemed to view the museum visit as an educative experience. These groups either moved together through the gallery, experiencing and sharing information as they went or moved independently, checking back with each other periodically to share information and experiences.

The striking feature of the family groups led by neutral parents was a total lack of involvement between family members, resulting in an almost total absence of parent-child interactions. The overriding trait was the parent's disattachment or neutrality toward the child or children.

The major characteristic of groups led by rule-enforcing parents was that they seemed to be primarily concerned that their children behave appropriately in the gallery, this "appropriateness" meeting some standard that they possessed. It seemed that rule-enforcing parents liked to be in control of their children and any experience that they were having. In fact, in some instances, the rule that the parent seemed to be enforcing was that the child must like what interested the parent.

The major limitations to this study were that the family groups were only observed in the Object Gallery, an exhibit space at the end of the maze-like museum, and that data were collected purely by ethnographic methods. Recent recommendations by a number of researchers suggest that studies of this nature should include a quantitative portion. The author also felt it important that the family's entire visit be observed and analyzed. These recommendations were relied upon heavily in the design of the dissertation study.

APPENDIX 2
DATA COLLECTION PROTOCOL

1. ATTENDING TO EXHIBIT
    standing in front of exhibit (facing)
    reading
    purposeful button pushing
    attending to exhibit volunteers
    touching "hands-on" exhibits
    focused scanning of exhibits
    pointing to exhibits
    discussing exhibits
    listening to headphones
    watching movies
    purposeful drawer pulling out (in Object Gallery)

3. ATTENDING TO SETTING
    verbal comments regarding setting
    watching feet as walking (e.g., cave)
    looking out of window
    moving between exhibits
    looking at ceiling
    general unfocused scanning
    manipulating but not using headphones
    reacting to alarm
    random button pushing
    random drawer pulling (in Object gallery)
    attending to:
        gift shop
        bathrooms
        vending machine
        map in lobby
        drinking fountains

5. ATTENDING TO SELF
    writing in notebook
    tying shoelaces
    personal grooming
    sitting with eyes closed
    talking to one's self

7. ATTENDING TO OWN SOCIAL GROUP
    If cannot hear conversation, assume 7
    If can hear:
        If very tightly related to exhibit, score 1
        If indirectly related or unrelated, score 7
    looking at someone in social group
    listening to someone in social group
    disciplining member of social group
    directing member of social group

9. ATTENDING TO OTHER PEOPLE
attending to researchers
attending to other people (same as 7 but directed at other people

5. MUSEUM FATIGUE
sagging body posture
yawning
shifting weight
leaning on exhibit cases
sitting down
"overload"
concern for time
bathroom
crying children

APPENDIX 3
BEHAVIOR FREQUENCIES PER FAMILY NORMALIZED FOR TIME SPENT IN EXHIBITS

Table 7

Behavior Frequencies Per Family Normalized for Time Spent in Exhibits

Family	Exhibit-related discipline	Exhibit-related pointing	Exhibit-related pointing out aspect
1	0.04	2.21	0.00
2	0.00	0.80	0.00
3	0.00	0.92	0.00
4	0.00	0.81	0.00
5	0.06	10.85	0.42
6	0.00	2.44	0.06
7	0.00	2.88	0.00
8	0.00	2.55	0.00
9	0.00	1.02	0.00
10	0.00	0.58	0.00
11	0.00	0.63	0.13
12	0.00	0.99	0.06
13	0.00	0.38	0.00
14	0.00	0.40	0.04
15	0.00	0.17	0.03
16	0.00	0.27	0.00
17	0.00	0.15	0.00
18	0.00	0.00	0.00
19	0.00	0.25	0.05
20	0.00	0.33	0.00
21	0.02	0.00	0.00
22	0.00	0.95	0.00
23	0.00	0.19	0.00
24	0.00	0.23	0.30
25	0.00	0.36	0.00
26	0.00	0.35	0.00
27	0.00	0.50	0.00
28	0.00	0.25	0.00
29	0.00	0.75	0.00
30	0.00	0.59	0.00
31	0.00	1.08	0.17
32	0.00	0.77	0.07
33	0.00	0.57	0.06
34	0.00	0.23	0.08
35	0.00	1.04	0.06
36	0.00	0.11	0.08
37	0.00	1.76	0.35

Table 7--continued

Family	Exhibit-related disciplining	Exhibit-related pointing	Exhibit-related pointing out aspect
38	0.00	0.78	0.01
39	0.00	0.72	0.02
40	0.00	0.32	0.00
41	0.00	0.08	0.00
42	0.00	0.58	0.00
43	0.00	0.28	0.00
44	0.00	0.76	0.04
45	0.00	1.44	0.00
46	0.00	0.91	0.03
47	0.00	0.63	0.02
48	0.00	0.77	0.02
49	0.00	0.22	0.00
50	0.00	0.54	0.02
51	0.00	0.90	0.00
52	0.00	0.64	0.13
53	0.00	0.70	0.11
54	0.00	0.34	0.04
55	0.00	1.00	0.11
56	0.00	0.18	0.00

Family	Exhibit-related questioning	Exhibit-related answering	Exhibit-related explanation
1	0.00	0.38	0.38
2	0.05	0.00	0.00
3	0.00	0.00	0.13
4	0.02	0.16	0.00
5	0.31	0.00	0.81
6	0.10	0.35	0.13
7	0.04	0.00	0.42
8	0.17	0.14	1.34
9	0.03	0.00	0.53
10	0.24	0.03	0.03
11	0.13	0.25	0.25
12	0.25	0.03	0.19
13	0.19	0.00	0.00
14	0.06	0.19	0.18
15	0.04	0.35	0.63
16	0.00	0.30	0.02
17	0.00	0.00	0.04
18	0.00	0.00	0.00
19	0.00	0.05	0.18

Table 7--continued

Family	Exhibit-related questioning	Exhibit-related answering	Exhibit-related explanation
20	0.08	0.06	0.10
21	0.00	0.00	0.00
22	0.17	0.13	0.68
23	0.00	0.00	0.00
24	0.00	0.43	0.55
25	0.09	0.00	0.21
26	0.06	0.00	0.19
27	0.44	0.06	0.44
28	0.25	0.25	0.25
29	0.00	0.00	0.00
30	0.19	0.56	0.28
31	0.08	0.33	0.58
32	0.63	0.06	1.64
33	0.03	0.00	0.00
34	0.00	0.00	0.06
35	0.00	0.03	0.29
36	0.00	0.03	0.06
37	0.08	0.38	0.53
38	0.10	0.10	0.03
39	0.05	0.10	0.58
40	0.04	0.00	0.04
41	0.00	0.00	0.00
42	0.08	0.11	0.28
43	0.09	0.00	0.50
44	0.02	0.04	2.80
45	0.25	0.00	0.50
46	0.30	0.18	0.62
47	0.01	0.04	0.30
48	0.02	0.22	0.43
49	0.00	0.00	0.00
50	0.18	0.02	0.07
51	0.01	0.00	0.07
52	0.05	0.14	1.20
53	0.22	0.06	0.17
54	0.12	0.07	0.03
55	0.42	0.40	0.25
56	0.04	0.18	0.23

Table 7--continued

Family	Exhibit-related reinforcing	Exhibit-related non-interaction	Exhibit-related listening
1	0.00	4.88	1.04
2	0.00	3.73	0.00
3	0.00	5.58	0.00
4	0.00	5.06	0.05
5	0.56	2.74	2.49
6	0.00	4.96	1.23
7	0.04	1.83	0.17
8	0.02	1.56	1.03
9	0.03	3.00	0.60
10	0.06	6.61	0.21
11	0.25	0.50	0.13
12	0.00	4.08	0.46
13	0.00	7.63	0.48
14	0.00	2.73	0.39
15	0.19	4.07	0.80
16	0.00	6.74	0.71
17	0.00	4.00	0.54
18	0.00	0.00	0.00
19	0.00	0.83	0.10
20	0.00	6.04	0.29
21	0.00	2.25	0.30
22	0.00	0.93	0.00
23	0.00	4.02	0.92
24	0.00	0.85	0.48
25	0.00	6.50	0.11
26	0.00	5.21	1.27
27	0.00	3.64	0.93
28	0.00	0.00	0.00
29	0.00	8.58	1.83
30	0.00	5.88	0.31
31	0.00	3.58	1.50
32	0.00	4.60	0.75
33	0.00	8.05	0.51
34	0.00	3.96	1.18
35	0.06	2.12	1.80
36	0.00	5.56	0.94
37	0.03	2.37	0.89
38	0.17	5.32	0.08
39	0.00	6.27	1.00
40	0.00	6.38	0.25
41	0.00	7.61	0.05
42	0.00	4.62	0.12
43	0.00	2.30	0.15
44	0.00	1.40	0.45
45	0.00	2.75	0.63
46	0.00	4.84	0.69

Table 7--continued

Family	Exhibit-related reinforcing	Exhibit-related non-interaction	Exhibit-related listening
47	0.00	6.15	1.06
48	0.00	3.72	0.46
49	0.00	4.90	0.54
50	0.00	5.52	0.70
51	0.00	4.35	0.17
52	0.00	2.04	0.42
53	0.00	5.07	0.20
54	0.00	4.15	0.11
55	0.13	3.60	2.08
56	0.00	5.35	0.28

Family	Exhibit-related non-verbal inter.	Exhibit-related related conversa.	Exhibit-related museum-related management
1	0.00	0.00	0.00
2	0.17	0.00	0.00
3	0.00	0.00	0.00
4	0.00	0.00	0.00
5	0.00	0.00	0.00
6	0.02	0.00	0.00
7	0.00	0.00	0.00
8	0.03	0.00	0.00
9	0.00	0.00	0.00
10	0.00	0.00	0.00
11	0.00	0.00	0.00
12	0.00	0.00	0.00
13	0.00	0.00	0.00
14	0.00	0.00	0.00
15	0.00	0.00	0.00
16	0.00	0.00	0.00
17	0.00	1.13	0.00
18	0.00	0.00	0.00
19	0.00	0.13	0.00
20	0.04	0.02	0.00
21	0.00	0.00	0.00
22	0.00	0.00	0.00
23	0.00	1.13	0.00
24	0.00	0.13	0.00
25	0.02	1.04	0.00
26	0.00	0.58	0.00
27	0.00	0.63	0.00

Table 7--continued

Family	Exhibit-related nonverbal inter.	Exhibit-related related conversa.	Exhibit-related museum-management
28	0.00	0.00	0.00
29	0.00	2.25	0.00
30	0.03	0.16	0.00
31	0.00	1.75	0.00
32	0.00	1.74	0.00
33	0.00	0.58	0.06
34	0.00	0.31	0.13
35	0.00	1.68	0.00
36	0.00	0.75	0.00
37	0.00	3.42	0.19
38	0.00	0.55	0.00
39	0.00	1.97	0.00
40	0.00	0.77	0.00
41	0.00	0.06	0.00
42	0.00	0.59	0.00
43	0.00	0.14	0.00
44	0.00	3.16	0.00
45	0.00	0.75	0.25
46	0.00	2.08	0.00
47	0.00	0.82	0.02
48	0.00	2.20	0.00
49	0.00	0.99	0.00
50	0.00	1.73	0.03
51	0.00	0.57	0.00
52	0.06	1.70	0.00
53	0.00	0.73	0.00
54	1.43	0.59	0.00
55	0.00	2.22	0.00
56	0.00	0.00	0.00

Family	Exhibit-related reading	Setting-related questioning	Setting-related answering
1	0.00	0.00	0.00
2	0.00	0.00	0.00
3	0.00	0.00	0.00
4	0.00	0.00	0.00
5	0.00	0.25	0.00
6	0.00	0.00	0.04
7	0.00	2.50	0.00
8	0.00	0.00	0.00
9	0.00	0.00	0.00

Table 7--continued

Family	Exhibit-related reading	Setting-related questioning	Setting-related answering
10	0.00	0.00	0.00
11	0.00	0.00	0.00
12	0.00	0.00	0.00
13	0.00	0.00	0.00
14	0.00	0.00	0.00
15	0.00	0.00	0.00
16	0.00	0.00	0.00
17	0.00	0.00	0.00
18	0.00	0.00	0.00
19	0.00	0.03	0.00
20	0.00	0.00	0.00
21	0.00	0.00	0.00
22	0.00	0.00	0.00
23	0.00	0.00	0.00
24	0.00	0.00	0.00
25	0.00	0.00	0.00
26	0.00	0.00	0.00
27	0.00	0.00	0.00
28	0.00	0.00	0.00
29	0.00	0.00	0.00
30	0.00	0.00	0.00
31	0.00	0.00	0.00
32	0.00	0.00	0.00
33	0.00	0.00	0.00
34	0.00	0.00	0.00
35	0.00	0.00	0.00
36	0.00	0.00	0.00
37	0.00	0.00	0.00
38	0.00	0.00	0.00
39	0.09	0.00	0.00
40	0.06	0.00	0.00
41	0.00	0.00	0.00
42	0.00	0.00	0.00
43	0.00	0.00	0.00
44	0.04	0.00	0.00
45	0.06	0.00	0.00
46	0.18	0.02	0.00
47	0.00	0.00	0.00
48	1.43	0.00	0.00
49	0.00	0.00	0.00
50	0.48	0.00	0.00
51	0.00	0.00	0.00
52	0.04	0.06	0.00
53	0.00	0.00	0.00
54	0.00	0.00	0.00
55	0.00	0.00	0.00
56	0.00	0.00	0.00

Table 7--continued

Family	Setting-related explanation	Setting-related child management	Setting-related inter.
1	0.00	0.00	1.75
2	0.00	0.00	2.30
3	0.00	0.00	4.17
4	0.00	0.00	6.46
5	0.00	0.37	4.77
6	0.00	0.13	0.75
7	0.00	0.00	4.25
8	0.06	0.00	1.59
9	0.00	0.00	1.76
10	0.00	0.00	2.29
11	0.00	0.00	0.38
12	0.00	0.00	2.13
13	0.00	0.00	2.64
14	0.00	0.00	1.50
15	0.00	0.00	2.52
16	0.00	0.00	2.84
17	0.00	0.00	1.04
18	0.00	0.00	0.25
19	0.00	0.00	0.38
20	0.00	0.00	0.95
21	0.00	0.00	0.98
22	0.00	0.00	2.78
23	0.00	0.00	1.04
24	0.00	0.00	1.83
25	0.00	0.00	1.16
26	0.00	0.00	1.56
27	0.00	0.00	4.94
28	0.00	0.00	0.25
29	0.00	0.00	0.67
30	0.00	0.00	1.63
31	0.00	0.00	1.50
32	0.00	0.00	0.47
33	0.00	0.00	1.07
34	0.00	0.00	1.68
35	0.00	0.00	0.49
36	0.00	0.00	2.64
37	0.00	0.00	2.54
38	0.03	0.00	0.75
39	0.00	0.00	0.78
40	0.00	0.00	2.36
41	0.00	0.00	0.81
42	0.00	0.00	1.17
43	0.00	0.00	3.38
44	0.00	0.00	1.31
45	0.00	0.00	1.56
46	0.00	0.00	1.39

Table 7--continued

Family	Setting-related explanation	Setting-related child management	Setting-related non-inter.
47	0.00	0.00	9.21
48	0.00	0.00	1.18
49	0.00	0.00	2.48
50	0.06	0.00	0.55
51	0.04	0.00	2.32
52	0.25	0.00	0.72
53	0.00	0.00	1.69
54	0.00	0.00	2.82
55	0.00	0.00	1.89
56	0.00	0.00	2.92

Family	Setting-related listening	Setting-related related conversa.	Setting-related museum-related management
1	0.33	0.00	0.00
2	0.00	0.00	0.00
3	0.00	0.00	0.00
4	0.00	0.00	0.00
5	0.87	0.25	0.00
6	0.60	0.19	0.00
7	0.00	0.00	0.00
8	0.00	0.00	0.00
9	0.08	0.00	0.00
10	0.00	0.00	0.00
11	0.00	0.00	0.00
12	0.00	0.00	0.00
13	0.00	0.00	0.00
14	0.00	0.00	0.00
15	0.00	0.00	0.00
16	0.00	0.00	0.00
17	0.00	0.00	0.00
18	0.00	0.00	0.00
19	0.00	0.00	0.00
20	0.00	0.00	0.00
21	0.00	0.00	0.00
22	0.00	0.00	0.00
23	0.00	0.00	0.00
24	0.00	0.00	0.00
25	0.00	0.00	0.00
26	0.00	0.00	0.00
27	0.00	0.00	0.00
28	0.00	0.50	0.00

Table 7--continued

Family	Setting-related listening	Setting-related related conversa.	Setting-related museum-related management
29	0.00	0.00	0.00
30	0.00	0.00	0.00
31	0.25	0.00	0.00
32	0.00	0.00	0.00
33	0.00	0.00	0.06
34	0.08	0.00	0.00
35	0.06	0.00	0.09
36	0.31	0.00	0.00
37	0.00	0.00	0.02
38	0.00	0.01	0.00
39	0.00	0.00	0.06
40	0.00	0.25	0.00
41	0.00	0.00	0.00
42	0.00	0.00	0.00
43	0.00	0.00	0.00
44	0.00	0.04	0.00
45	0.00	0.00	0.00
46	0.05	0.05	0.08
47	0.01	0.08	0.00
48	0.00	0.04	0.00
49	0.13	0.00	0.00
50	0.02	0.03	0.05
51	0.00	0.00	0.00
52	0.70	0.02	0.00
53	0.04	0.00	0.00
54	0.00	0.00	0.00
55	0.00	0.09	0.02
56	0.00	0.00	0.00

APPENDIX 4
BEHAVIOR FREQUENCIES FOR DYAD TYPES

Table 3
Behavior Frequencies for Dyad Types

Behavior	Father-son	Father-daughter	Mother-son	Mother-daughter
Exhibit-related disciplining	0.00	0.00	0.00	0.00
Exhibit-related pointing	0.58	0.47	0.82	1.06
Exhibit-related pointing out aspect	0.03	0.04	0.07	0.01
Exhibit-related questioning	0.10	0.20	0.10	0.10
Exhibit-related answering	0.09	0.48	0.18	0.11
Exhibit-related explanation	0.18	0.48	0.18	0.17
Exhibit-related reinforcing	0.02	0.00	0.04	0.17
Exhibit-related non-interact.	4.38	4.53	3.72	4.10
Exhibit-relate listening	0.50	0.53	0.54	0.44

Table 3--continued

Behavior	Father-son	Father-daughter	Mother-son	Mother-daughter
Exhibit-related nonverbal interaction	0.15	0.00	0.01	0.00
Exhibit-related related conversation	0.50	0.77	0.99	0.29
Exhibit-related museum-related management	0.01	0.00	0.04	0.00
Exhibit-related reading	0.02	0.00	0.00	0.00
Setting-related to questioning	0.00	0.00	0.01	0.31
Setting-related answering	0.00	0.00	0.00	0.00
Setting-related explanation	0.00	0.00	0.02	0.01
Setting-related child management	0.01	0.00	0.00	0.01
Setting-related non-interact.	2.61	1.68	1.86	1.94
Setting-related listening	0.02	0.04	0.07	0.06

Table 3--continued

Behavior	Father-son	Father-daughter	Mother-son	Mother-daughter
Setting-related related conversation	0.00	0.00	0.03	0.07
Setting-related museum-related management	0.00	0.00	0.01	0.01

APPENDIX 5
NON-SIGNIFICANT REPEATED MEASURES ANOVA

Table 9
Summary Repeated Measures ANOVA--Exhibit-related pointing

Source	df	Type III SS	MS	*F*	PR >F
Between					
Family type (F)	2	1.13	0.56	0.49	0.62
Dyad type (D)	3	1.19	0.40	0.34	0.79
F X D	5	2.21	0.44	0.38	0.86
Error	35	40.33	1.15		
Within					
Exhibit type (E)	3	2.86	0.95	2.07	0.12
E X F	6	1.18	0.20	0.43	0.82
E X D	9	2.25	0.25	0.54	0.80
E X F X D	15	2.20	0.15	0.32	0.98
Error	105	48.26	0.46		

Huynh-Feldt epsilon = 0.80

Table 10
Summary Repeated Measures ANOVA--Exhibit-related pointing out aspect

Source	df	Type III SS	MS	*F*	PR > F
Between					
Family type (F)	2	0.02	0.01	0.54	0.66
Dyad type (D)	3	0.09	0.03	2.16	0.11
F X D	5	0.14	0.03	1.91	0.12
Error	35	0.50	0.01		
Within					
Exhibit type (E)	3	0.02	0.01	0.54	0.66
E X F	6	0.06	0.01	0.78	0.59
E X D	9	0.08	0.01	0.76	0.65
E X F X D	15	0.25	0.02	1.37	0.18
Error	105	1.26	0.01		

Huynh-Feldt epsilon = 1.00

Table 11
Summary Repeated Measures ANOVA--Exhibit-related answering

Source	df	Type III SS	MS	*F*	PR > F
Between					
Family type (F)	2	0.07	0.03	0.63	0.54
Dyad type (D)	3	0.20	0.06	1.21	0.32
F X D	5	0.51	0.10	1.90	0.12
Error	35	1.88	0.05		
Within					
Exhibit type (E)	3	0.12	0.04	0.75	0.49
E X F	6	0.35	0.06	1.09	0.37
E X D	9	0.26	0.03	0.54	0.80
E X F X D	15	0.59	0.04	0.74	0.70
Error	105	5.60	0.05		

Huynh-Feldt epsilon = 0.77

Table 12
Summary Repeated Measures ANOVA--Exhibit-related explanation

Source	df	Type III SS	MS	*F*	PR > F
Between					
Family type (F)	2	6.47	3.24	2.31	0.11
Dyad type (D)	3	8.01	2.67	1.91	0.15
F X D	5	8.89	1.78	1.27	0.30
Error	35	48.95	1.40		
Within					
Exhibit type (E)	3	5.04	1.68	1.48	0.24
E X F	6	4.63	0.77	0.68	0.56
E X D	9	11.84	1.32	1.16	0.34
E X F X D	15	9.88	0.66	0.58	0.77
Error	105	119.12	1.13		

Huynh-Feldt epsilon = 0.48

Table 13
Summary Repeated Measures ANOVA--Exhibit-related listening

Source	df	Type III SS	MS	*F*	PR > F
Between					
Family type (F)	2	4.51	2.25	1.42	0.26
Dyad type (D)	3	1.76	0.59	0.37	0.77
F X D	5	6.71	1.34	0.85	0.53
Error	35	55.53	1.59		
Within					
Exhibit type (E)	3	1.60	0.53	0.41	0.67
E X F	6	4.52	0.75	0.58	0.68
E X D	9	5.28	0.59	0.45	0.84
E X F X D	15	11.80	0.79	0.61	0.81
Error	105	136.11	1.30		

Huynh-Feldt epsilon = 0.68

Table 14
Summary Repeated Measures ANOVA--Exhibit-related conversation

Source	df	Type III SS	MS	*F*	PR >F
Between					
Family type (F)	2	8.59	4.29	1.01	0.37
Dyad type (D)	3	8.48	2.83	0.66	0.58
F X D	5	4.69	0.94	0.22	0.95
Error	35	148.78	4.25		
Within					
Exhibit type (E)	3	3.63	1.21	0.71	0.50
E X F	6	7.03	1.71	0.69	0.60
E X D	9	6.18	0.69	0.40	0.88
E X F X D	15	14.46	0.96	0.56	0.84
Error	105	179.34	1.71		

Huynh-Feldt epsilon = 0.67

Table 15
Summary Repeated Measures ANOVA--Setting-related answering

Source	df	Type III SS	MS	*F*	PR > F
Between					
Family type (F)	2	0.0001	0.00	0.15	0.86
Dyad type (D)	3	0.0001	0.00	0.28	0.84
F X D	5	0.0001	0.00	0.17	0.97
Error	35	0.006	0.0002		
Within					
Exhibit type (E)	3	0.0002	0.00	0.32	0.63
E X F	6	0.0002	0.00	0.15	0.91
E X D	9	0.0004	0.00	0.28	0.88
E X F X D	15	0.0004	0.00	0.17	0.99
Error	105	0.02	0.0002		

Huynh-Feldt epsilon = 0.43

Table 16
Summary Repeated Measures ANOVA--Setting-related non-interaction

Source	df	Type III SS	MS	*F*	PR > F
Between					
Family type (F)	2	10.64	5.32	0.50	0.61
Dyad type (D)	3	9.84	3.28	0.31	0.82
F X D	5	31.39	6.28	0.59	0.71
Error	35	371.61	10.62		
Within					
Exhibit type (E)	3	16.80	5.60	0.71	0.48
E X F	6	20.11	3.35	0.42	0.77
E X D	9	22.57	2.51	0.32	0.91
E X F X D	15	25.50	1.70	0.22	0.99
Error	105	829.22	7.90		

Huynh-Feldt epsilon = 0.60

Table 17
Summary Repeated Measures ANOVA--Setting-related conversation

Source	df	Type III SS	MS	*F*	PR > F
Between					
Family type (F)	2	0.002	0.001	0.25	0.78
Dyad type (D)	3	0.006	0.002	0.46	0.71
F X D	5	0.009	0.002	0.42	0.83
Error	35	0.15	0.004		
Within					
Exhibit type (E)	3	0.002	0.00	0.14	0.81
E X F	6	0.007	0.001	0.25	0.86
E X D	9	0.004	0.00	0.09	0.91
E X F X D	15	0.02	0.001	0.22	0.98
Error	105	0.52	0.005		

Huynh-Feldt epsilon = 0.50

BIOGRAPHICAL SKETCH

Lynn Diane Dierking was born in Elgin, Illinois, on February 1, 1956. She grew up in St. Petersburg, Florida, graduating from Northeast High School in 1974. Ms. Dierking attended the University of Miami and obtained her Bachelor of Science degree with a major in biology, graduating magna cum laude in 1978. In 1981, Lynn completed her Masters of Arts in Education degree in science education at the University of Florida. Ms. Dierking has diverse experience as an educator, teaching middle school and high school biology and physical science in Miami, also working on the Educational Programming Staff of the Museum of Science in Miami and the Florida State Museum in Gainesville and most recently a Research Associate in the Office of Educational Research at the Smithsonian Institution in Washington, D.C. Lynn currently is Co-Principal Investigator and Coordinator of the Community Learning Exchange, a National Science Foundation applied research project, initiated by the Smithsonian and now in its implementation phase and sponsored by the Howard County Chamber of Commerce, in Columbia, Maryland. Ms. Dierking is on the editorial board for the Journal of Museum Education and consults on a variety of museum-related projects. Lynn resides in Annapolis, Maryland.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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Professor of Instruction and
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